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XXI

HEALTH VALUE OF CERTAIN FOODS

MILK

By J. TAVROGES, B.Sc., A.I.C., Chief Chemist to "Cow and Gate," Ltd., Guildford.

THERE is probably no food which has been more intensely studied in all its aspects and which has a more natural right to such study than milk. Its importance as a leading article in the diet of man has always been acknowledged, and the following review of the facts will attempt to show that this high estimate is justified.

Milk is the secretion of the mammary gland, and is designed by Nature for the nourishment of the young of the parent which secretes the fluid. In most civilised countries the term "milk" is usually applied to the secretion of the cow, owing to the more extensive breeding of this animal and to its adaptability to the needs of mankind. The milk of other mammals, however, has also been pressed into the service of man; thus the milk of the goat, sheep, mare, buffalo is employed in different countries, and at times for different purposes. The milk of sheep, for example, is used in the preparation of the famous Roquefort cheeses; and occasionally the milk of the ass is found necessary for the feeding of a difficult infant.

The compositions of all milks are qualitatively similar in that they all contain the principal elements of nutrition—namely, fat, protein, carbohydrate, mineral matter, water and vitamins. Quantitatively, however, there

[*Sport and General*

MILKING TIME

Pedigree Friesian cows supplying Nature's most perfect food.

is a great dissimilarity in the composition of all milks. The following table gives the percentage composition of the milks of various mammals and illustrates the differences that exist between them :—

TABLE I
(Abt. Modified)

Mammal	Specific Gravity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total Solids
Man	1.0298	87.58	0.80	1.21	2.01	3.74	6.37	0.30	12.42
Cow	1.0321	87.41	3.00	0.40	3.40	3.74	4.70	0.75	12.65
Ass	1 ·32	90.12	0.79	1.06	1.85	1.37	6.19	0.47	9.88
Goat	1.0305	86.68	2.87	0.89	3.76	4.07	4.64	0.85	13.12
Mare	1.0347	90.58	1.30	0.75	2.05	1.14	5.87	0.36	9.42

There are other essential differences to be found between the milks of different mammals, such for example as in the chemical nature of the fat, protein, and mineral matter, and the physical conditions of these components. All these serve to point to that vital lesson of Nature—that the best food and nourishment for the young of a species is to be found in the milk of its mother.

As an illustration of how the compositions of the milks of different species are adapted to the requirements of the offspring, we have only to consider the percentages of protein, that element of nutrition which is responsible for growth and tissue repair, and compare them with rates of growth.

The human infant, which doubles its birth weight in six months, receives from its mother's milk a protein content of 2.01 per cent. The calf, which doubles its weight in six weeks, receives a protein content of 3.4 per cent. The pig, which doubles its weight in 18 days, receives a protein content of 6 per cent. The rabbit, which doubles its weight in a week, receives a protein content of 15 per cent.

This infallible law of Nature cannot be too strongly stressed to all who have the welfare of the young at heart.

It might be asked why milk—and here and hereafter we will restrict our observations to the milk of the cow—should have been adopted by civilised man in all ages as an indispensable article of diet. The answer to this question is more easily given in the light of our present knowledge concerning nutrition. Milk is the food which most closely approaches perfection and completeness in itself. It contains all the elements which are necessary for satisfactory nutrition, and in a suitably balanced form.

Proteins.

The two chief proteins contained in milk are casein and lactalbumen. These contain all the constituent amino-acids which are necessary for the rebuilding of the proteins contained in our body tissues. The balance between these two proteins is not ideal for the growing human body, in so far that in cow's milk, lactalbumen forms only about one-seventh of the protein, whereas in human milk it forms about two-thirds of the protein. Lactalbumen is the more important protein in that it contains two amino-acids essential for growth, viz., cystine and lysine.

Milk Fat.

The fat in milk consists of 30-40 per cent. of olein, a slightly larger percentage of palmitin, and a little stearin. In addition, there is about 7 per cent. volatile fatty acids including butyric acid from which is derived the characteristic and pleasant flavour of all milk products. When milk fat is separated from milk, either as cream or butter, we have foods whose palatibility and acceptability are unequalled by imitative preparations.

Carbohydrates.

The carbohydrate in milk is lactose or milk sugar. Lactose is a white crystalline solid with a slightly sweetish taste, which, in solution, is readily converted by certain bacteria into lactic acid. It is in this way that lactose in milk becomes the starting point of subsequent sourness.

Mineral Matter.

The mineral salts in milk are particularly rich in lime and phosphates. There is also a good proportion of potassium and sodium. This high percentage of lime renders milk one of the most important sources of calcium in man's dietary, and more particularly, since calcium is also a necessary requirement for the formation of bone in the growing organism, in the dietary of infants.

The proportion of iron in milk is very small and may be a contributory factor to the

incidence of anæmia in infants fed exclusively on cow's milk.

This new and interesting branch of the science of nutrition has been applied to the study of milk with interesting results. It has been established that provided a cow is given a natural diet and environment, is allowed to feed on pasture, and is exposed to sunshine, her milk will contain all the known vitamins. Vitamin C, the anti-scorbutic factor, is present in the smallest degree. When, however, the cow is given an artificial feed of roots and hay, or if, from any cause, she cannot feed on natural succulent pasture and is kept out of direct contact of sunshine, her milk will show a marked deficiency in vitamins A and C, the growth-promoting and the anti-scorbutic factors respectively. This is an important consideration which must not be lost sight of in the feeding of infants and others to whom a well-balanced source of vitamins is a necessity. Fortunately, there are now a number of preparations that can be bought, containing cod-liver oil and orange juice – two concentrated sources of vitamins A, C and D—that can make good the deficiencies in such milks.

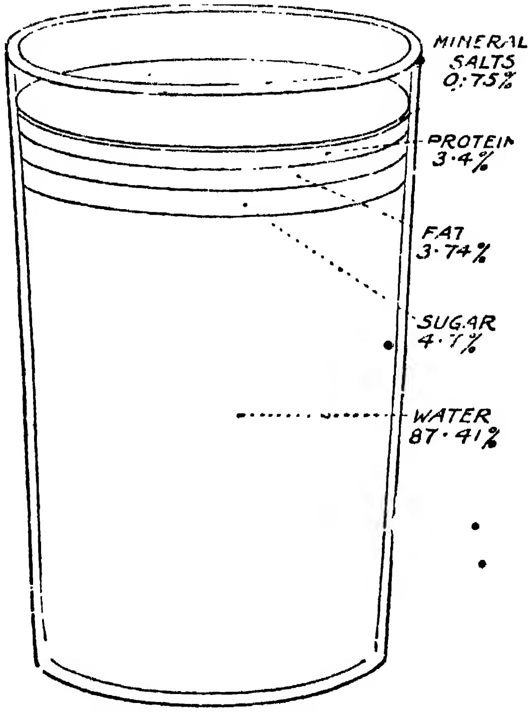
Vitamins.

It will thus be readily appreciated from the foregoing summary that we have in milk one of the most unique foodstuffs with which Nature has blessed us, and one on which all who have at heart the welfare of public health and of humanity in general should continuously focus their energies in an attempt to maintain the highest level in its quality.

VARIATIONS IN THE COMPOSITION OF MILK

Whilst the composition of milk was given in Table 1, it is not intended to suggest that all milk will conform to this standard. Milk varies largely in its composition, such variation being dependant on a number of causes, amongst which are :—

1. **Breed of Cow.**—The influence of the breed of cow on the composition is shown in the following table (2) :—



THE COMPOSITION OF MILK

Showing the average constituents of a tumbler of cow's milk ; it also contains all the known vitamins.

TABLE II

(*Vieth*)

Breed	Total Solids						Solids no Fat %		
	Max.	Min.	Ave	Max.	[illegible]	Aver			Aver.
Dairy Shorthorn	18.7	10.2	12.90		1.3	4.03	10.6	7.(	8.87
Pedigree	16.8	10.5	12.86	7.5	1.9	4.03	9.8	7.(	8.83
Jersey ..	19.9	11.0	14.80	9.8	2.0	5.66	10.4	8.1	9.23
Kerry ..	18.6	10.6	13.70	10.5	1.8	4.72	10.6	4.9	8.98
Red Pollard	16.2	9.7	13.22	6.6	[illegible]	4.34	10.2	7.1	8.88
Sussex ..	17.4	11.5	14.18	7.6	2.9	4.87	10.3	8.4	9.31
Montgomery	16.1	10.2	12.61	6.[illegible]	1.4	3.59	10.0	7.9	9.02
Welsh ..	17.6	11.9	14.15	8.3	3.0	4.91	9.6	8.9	9.24

2. Seasonal Variations.—There are distinct variations in the composition of milk during the seasons. Winter milk is richest in quality, so far as chemical composition is concerned. Summer milk is poorest ; spring and autumn occupy intermediate places.

3. Morning and Evening Variations.—It is the practice in England to milk cows twice a day, and the composition of the milk obtained at each milking differs appreciably. The evening milk is invariably richer than

[E.N.A.

SELLING ASSES' MILK IN TOULOUSE

the morning—a result of the unequal intervals between the milkings.

4. Milking Variations.—The composition of milk varies continuously during expression from the udder. The first part of the milk—known as "fore milk"—is poorest in cream. The last part—known as "strippings"—is richest in cream. Thus, Boussingault has recorded the examination of milk drawn in portions from a cow. The first portion contained only 1.70 per cent. fat; the last portion contained 4.08 per cent.

5. Other Variations.—Such causes as ill-health, weather, feeds, excitement of cow, change of environment, may have an important effect on the composition of milk.

Another cause for variation is advance of lactation. It is found that the quality of milk improves as lactation advances, at any rate after the first month or so. Thus Dr. Crowther has shown for a group of 26 cows, the following variations :—

Month after Calving	Fat per cent.	Non-fatty solids per cent.
1	4.18	9.15
2	3.74	8.74
3	3.57	8.72
4	3.68	8.68
5	3.66	8.61
6	3.66	8.54
7	3.79	8.52
8	3.77	8.66
9	3.84	8.76
10	3.94	8.87

Adulteration. It is not surprising, though very unfortunate, that such an important and valuable food stuff as milk should be a much adulterated article. By skimming the cream which rises to the surface of milk, and which is the most expensive constituent of milk, or by the addition of water, the dishonest trader is able to deceive the consumer into accepting what appears, superficially, to be the genuine article. Adulteration of milk has been rampant since perhaps the first pint was sold; and it has only been in recent years, thanks to the ever-increasing vigilance of our public health authorities and the discerning interest shown by the public in matters of food and hygiene, that the menace has been checked.

As with other foodstuffs, there are legal standards which are fixed for milk, and any milk sold under these standards is considered to be adulterated unless the contrary is proved. In this country the standards fixed are (Sale of Milk Regulations, 1901) :—

Fat	3.0	per cent.
Non-fatty Solids	8.5	„ „

Unless it can be proved to the contrary, milk which is sold with a fat content under 3.0 per cent. is considered legally to be skimmed of its cream; and milk with a non-fatty solid content of under 8.5 per cent. to contain added water.

The Public Health (Milk and Cream) Regulations 1912, prohibit the addition of any preservative or thickening substance to milk. The Milk and Dairies (Consolidation) Act, 1915, prohibits the addition of any colouring matter to milk.

In addition to being a complete food for man, milk is also an . ide medium for the growth of micro-organisms. This aspect of milk shows indeed one of its chief disadvantages from the standpoint of safety, and around it has raged controversy of the most important kind in so far as it relates to public health.

Bacteriology.

Courtesy] [Cow & Gate, Ltd.

A LABORATORY FOR TESTING MILK

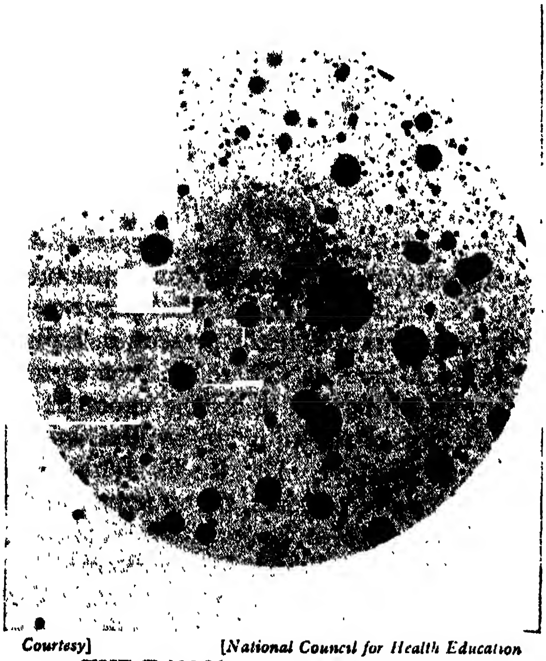
There are roughly two types of microbes which may be present in milk—the harmless or saprophytic bacteria, and the harmful or pathogenic ones. Some produce acid, others cause clotting of the milk. Some peptonise or digest the proteins, others appear to do nothing of importance.

Bacteria are introduced into milk mainly by contamination—through the milker's hands, dirty utensils, unclean cow's teats, hairs, dirty sheds, etc. Once these bacteria are present in the milk, they appear to grow at an alarming rate. Some of these bacteria (*e.g.*,the acid producers) hinder the growth of others ; but generally speaking, the growth of bacteria goes on rapidly, unless such steps as cooling or heating are taken.

Widespread epidemics such as diphtheria, typhoid and scarlet fevers, infective sore throat, diarrhœa, and dysentery have resulted from contaminated milk. Still more serious is the spread of tuberculosis among children, from cows suffering themselves from the disease.

Dr. Savage, in 1912, published his opinion that 25 to 30 per cent. of the milch cows in this country suffered from tuberculosis ; and in 1926 he still believed that " a material percentage of non-respiratory tuberculosis in man is of bovine origin, and directly due to infected milk." It was also pointed out that over 3000 deaths a year in England are due to tuberculosis of bovine origin, to say nothing of the large number of infections not ending in death, but causing a great amount of suffering.

Reports from Medical Officers of Health during 1929 showed that 5-10 per cent of samples taken at random from milk supplies, contained the tubercle bacillus. This regrettable state of affairs has not been lost



Courtesy] [National Council for Health Education

THE DANGER OF DIRTY MILK

A microphotograph of 1/10,000th of a cubic centimetre of dirty milk, showing the dense colonies of bacteria (22 million per c.c.).

sight of by our health authorities, though progress is slow.

Fortunately there are methods available by means of which it is possible to destroy all these harmful organisms before the milk is consumed; and by adopting such prophylactic measures—as pasteurisation, sterilisation, and drying—we are able to confer a high degree of safety, from the point of view of bacteriological freedom, on our milk supplies.

It *is* possible to produce a milk supply free from dangerous organisms, and safe and clean as a food; but none the less, it must be admitted that for the present such milk must remain an expensive commodity. The maintenance of a herd of cows free from tuberculosis, and the extra care and intelligence required to prevent the onset of bacterial invasion, are a costly business, and the price of milk produced under such controlled conditions renders its distribution prohibitive to the majority of people.

GRADED MILK

Producers of such clean milk may, if they so desire it, label their milk under different grades and standards, provided they comply with regulations made by the Ministry of Health under the Milk (Special Designations) Order, 1922. These grades and standards are:—

I. "CERTIFIED" MILK.—This milk must not contain (*a*) more than 30,000 bacteria per cubic centimetre; (*b*) any B. coli in one-tenth of a cubic centimetre, and shall not be heated at any stage. It must also be produced from cows which have passed a prescribed tuberculin test and veterinary examination. The whole herd must be submitted to the test and examination at intervals of six months. The milk must be bottled on the farm.

II. GRADE A (TUBERCULIN-TESTED) MILK.—This milk must be produced under exactly the same conditions as Certified Milk, but can be bottled before distribution. It must not contain (*a*) more than 200,000 bacteria per cubic centimetre; (*b*) any B. coli in one-hundredth of a cubic centimetre.

III. GRADE A MILK.—This milk is similar to II., but the tuberculin test is not required. A veterinary examination, however, is required every three months instead of every six months.

These graded milks are, bacteriologically, the best *raw* milks obtainable. They constitute roughly, about 1 per cent. of the total milk consumed in this country. The rest of our milk supplies are for the greater part pasteurised. Bacteriological examination of the milk does not always reveal a happy state of affairs. Thus in 1926, the Lister Institute for Preventive Medicine took 25 samples of milk at random from London dairies, and examination gave the following average results:—

Bacterial count per cubic centimetre	1,890,000
B. Coli at least per cubic centimetre	1,000

Pasteurisation is the name given to the process discovered and utilised by that great scientist, Pasteur, for the destruction of harmful bacteria in food beverages. As applied to milk, it consists in heating the milk to a temperature of 145°-150° F. for a period of half an hour and immediately cooling to a temperature of not more than 55° F.

Pasteurisation.

Pasteurised milk can only be sold as such under licence, and must conform to the conditions of the above process, and must not be heated more than once. In addition, at any time before delivery to the consumer, it must not contain more than 100,000 bacteria per cubic centimetre.

The pasteurisation of milk, if carried out intelligently, efficiently and conscientiously, results in the destruction of about 98 per cent. of the organisms originally present, including the tubercle bacillus. There has been a great difference of opinion as to the exact lethal temperature of the tubercle bacillus, which is highly resistant. Dr. R. G. White has recently shown, however, that a temperature of 145° F. for half an hour can be relied on to render a milk fairly safe from tubercle.

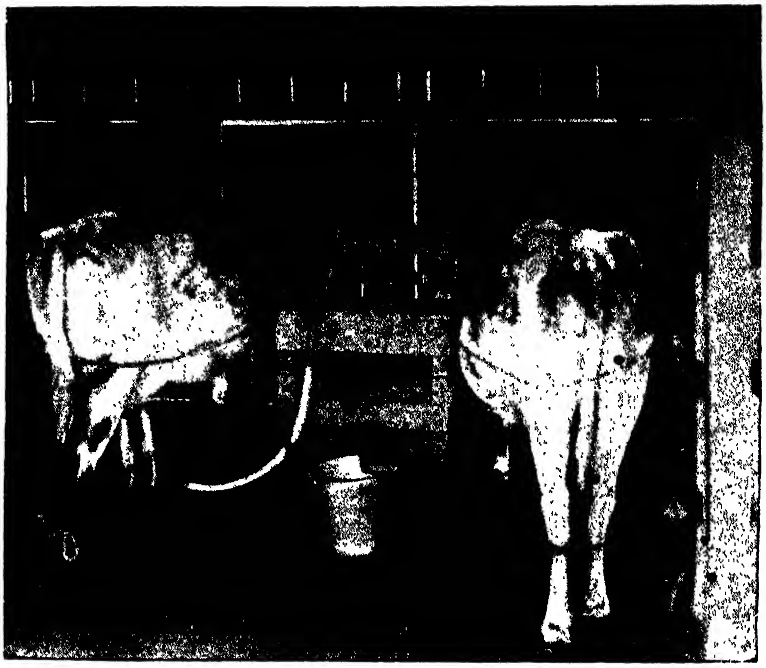
In pasteurisation, we have, therefore, a means of providing a most valuable foodstuff, free from bacterial contamination.

Unfortunately, the process of pasteurisation results also in other changes in milk,

physical and chemical, which have been considered by some to constitute a serious loss, and by others, a negligible loss in its nutritive value.

Various investigations have been and are still being carried out to discover the changes which take place as a result of heating milk to the conditions necessitated by pasteurisation. The results of these are briefly :—

I. Calcium Salts.—These are reduced by precipitation. Thus, McGee and Harvey have recently shown that 20 per cent. of the diffusible calcium salts is lost on pasteurisation. Fortunately, cow's milk contains an abundance of lime salts, and this loss does not render pasteurised milk deficient in this respect for human needs.



Courtesy] [Glaxo, Ltd.

HYGIENIC MILKING METHODS

Milking cows by machinery, a process which is replacing the germ-conveying hand method on many up-to-date farms.

II. Ferments.—These are destroyed by heat ; but it has been shown—notably by Lane-Claypon—that their loss has little or no bearing on the nutritive value of milk.

III. Immune Substances.—The loss of immune substances in cow's milk has no biological result on man ; their special properties of immunity are of value only to the new-born calf.

IV. Vitamins.—The partial destruction of vitamins which results on pasteurisation, is of more serious consequence—particularly if the original milk was not rich in these factors. Slow heating in the presence of air, such as occurs in pasteurisation, has a destructive effect on the C and D factors.

The heating of milk twice or more—as is often done in the home—results in even greater loss of vitamins. Infants fed on such milk are liable to the distressing eye complaint Xerophthalmia, and to scurvy, unless prophylactic measures such as cod-liver oil and fruit juice are added to the diet.

One of the shortcomings of pasteurisation is that it fails to destroy the sporing type of bacteria—which are highly resistant. In order to attain complete sterilisation, it is necessary to heat milk to a temperature above boiling point for a little time. The ordinary methods of sterilisation result in a milk of a decidedly cooked flavour, with the sugar more or less caramelised, giving it a brownish colour, with the calcium salts precipitated to a greater degree than in pasteurisation, and with the vitamin value lowered.

Sterilisation.

A recent method of sterilisation—the Jonas Nielson method—by which the milk is heated by super-heated steam at about 270° F. in closed pipes for 50-60 seconds—claims to overcome these disadvantages. It is believed, however, that vitamin C is destroyed.

Another method of reducing bacterial contamination of milk, and so prolonging its sterility, is presented in the form of condensed milks. Condensed milks are usually prepared by first heating milk to boiling point, and then concentrating it *in vacuo* to about a third of its

Condensed Milks.

original bulk with or without the addition of cane sugar. With the unsweetened variety, the milk after concentration is sterilised to a temperature of about 280° F. The sweetened variety is never sterilised.

The unsweetened variety will not keep once the tin is re-opened. The sweetened variety will keep longer owing to the increased viscosity which the sugar confers on the milk, and which retards bacterial growth.

Condensed milks are by no means completely sterile ; and the presence of pathogenic organisms is not unknown. The phenomenon of " blown " tins—the *bête noir* of the industry—is due to the activity of bacteria. There is, however, a considerable reduction in the number of organisms, and from the bacteriological standpoint, condensed milks are decidedly superior to unclean raw milk.

Condensed milks are usually deficient in vitamins owing to the prolonged heating to which they are subjected.

The sale and consumption of condensed milk in this country is controlled by the Condensed Milk Regulations (1923, 1927) by which all condensed milks must contain not less than :—

	Fat per cent.	Total Milk Solids per cent.
Full cream (sweetened) ..	9.0	31.0
Full cream (unsweetened)	9.0	31.0
Skimmed (sweetened) ..	—	26.0
Skimmed (unsweetened)	—	20.0

Further, the variety of condensed milks—*i.e.*, whether full cream or skimmed—must be clearly printed on the label, together with a declaration of the number of pints of liquid milk to which the contents of the tin are equivalent.

Of all methods of sterilisation, it is now agreed that the safest and best, and those which have the least ill effect on the nutritive qualities of the original milk, are those which are provided by desiccation. In these methods the object aimed at is to remove all but a very small percentage of the water of the milk, at a temperature which is sufficient to sterilise the final product, and to produce a powder, which when mixed again with a requisite quantity of boiled water, will reconstitute the original milk in a sterile form.

Dried Milks.

The methods used in reducing milk to powder form may be divided broadly into two categories :—

(1) Roller Film processes; (2) Spray processes.

In the former, milk is fed on to steam heated rollers on which it evaporates rapidly at a high temperature and forms a thin film. Fixed to the rollers, which rotate about their axes, are knives which scrape off the film of milk powder. In these processes, the milk is kept for a short period—2 to 4 seconds—at a high temperature, and a practically complete sterilisation takes place.

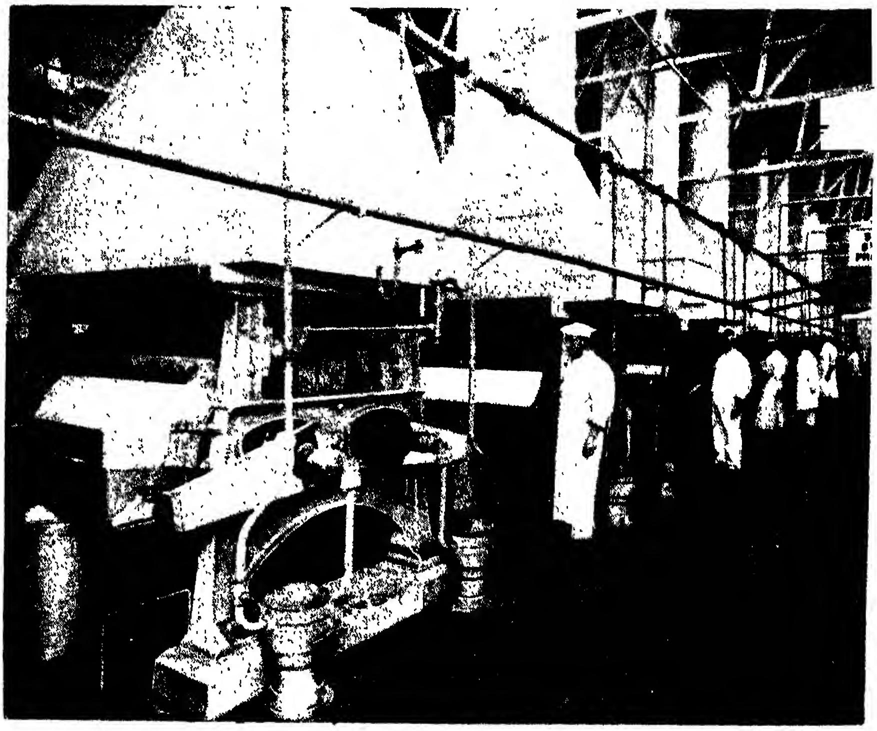
In the latter processes,

Courtesy] [A.P.V. Co.

A MODERN PASTEURISING PLANT
Heating and cooling machines in a large Edinburgh dairy.

milk is sprayed into a chamber, where it meets a current of hot air. The water is removed by evaporation, and the milk powder falls to the bottom. In most spray processes the milk is condensed prior to spraying. In both methods, there is a considerable reduction in the bacteriological content of the original milks.

The chemical changes which take place in the milk during drying are similar to those which occur in pasteurisation, and recent researches have shown that these changes, as in the case of pasteurised milks, have no biological significance.



Courtesy] [Cow & Gate, Ltd.

AT WORK IN A DRIED MILK FACTORY

The roller-drying machines—one of the methods by which milk is sterilised and converted into powder.

Investigations into the vitamin content of dried milks show that where they are prepared by roller processes, there is little or no change from the original milk. Where the spray process is employed, however, there is a reduction. This is easily understood when it is remembered that air (or oxygen) has a destructive effect on vitamins.

The high temperature used in roller processes breaks down the casein of the milk into a more digestible form. A roller dried milk gives in the stomach a fine flocculent curd which is more easily assimilated than the heavy clot which is given by raw cow's milk, and spray dried milks.

Other advantages of dried milks are that they will keep more or less indefinitely ; they will not go sour and therefore are not liable to the same contamination in the home to which liquid milk is subjected. The increasing consumption of dried milk—particularly for infant feeding—renders it an important article of diet in the health of the nation.

The sale and consumption of dried milk in this country is controlled, like condensed milk, by the Dried Milk Regulations (1923, 1927). These regulations lay down certain minimum fat standards for the different varieties of dried milks, *e.g.* :—

	Minimum Fat Percentage in Powder
Full Cream	26
Three-quarter Cream	20
Half Cream	14
Quarter Cream	8

Dried milks must also be suitably labelled with a declaration, giving the number of pints of liquid milk to which the contents of the package are equivalent.

The importance of the inclusion of milk and milk products in our diet cannot be

Courtesy] [*National Milk Publicity Council*

THE EFFECTS OF MILK ON GROWING CHILDREN

A poster which illustrates the effects of Dr. Corry Mann's experiments with milk in the diet of school children.

over-emphasised. Its completeness, its high value in infancy and convalescence, render it one of our most essential foodstuffs. McCollum, the eminent biochemist, attributes the superiority of European civilisation to the inclusion of milk and milk products in the diet. The recent interesting experiments of Dr. Corry Mann in England, and Dr. J. B. Orr in Scotland, on the great improvements which were noted in the physical well-being of boys fed on milk products, serve to confirm previous experience and to emphasise the unique nature of this class of foodstuffs.

Summary.

Yet, in spite of this knowledge, the consumption of milk per capita of population in this country, is extremely low. This is illustrated by the following statistics compiled by the U.S. Department of Agriculture.

ANNUAL CONSUMPTION PER HEAD OF LIQUID MILK

	American Gallons
Denmark (1914)	68.5
America (1925)	53
Canada (1916)	26
United Kingdom (1918) ..	22

On an average, the daily consumption of milk in England is about a quarter of a pint per head. While there are clear indications that this figure is steadily increasing, it is far from the minimum average which is agreed on by nutrition authorities—namely, one pint per head.

It is maintained by many that the low consumption of milk in this country is due to —and justified by—the poor and unclean methods of production. It is illogical, however, to condemn an article because it has been wrongly produced. Rather should our efforts be constructive in raising such an all-important foodstuff to a standard of safety which will yield it a consumption compatible with its value.

MILK AND LONGEVITY

By JAMES A. TOBEY, M.S., Dr.P.H., Fellow of the American Public Health Association.

WHAT we eat or do not eat exerts a definite effect on how long we live. There are, of course, many factors which influence longevity, beginning with heredity and run-

ning the gamut of environment, but nutrition is certainly one of the most important of them all, for science has amply demonstrated in recent years that, other factors being equal, the span of life can be made to depend upon the nature and quality of our foods.

Extension of human life is one thing, improvement of it is another, for as a Roman philosopher sagely remarked some two thousand years ago, " It is not life to live, but to be well." Not only does the adequate and well-balanced diet tend to prolong human life, but it also makes living better, by contributing to the health, happiness, and efficiency of the individual. All this may sound superlative and enthusiastic, but consider for a moment the human experience and the scientific evidence which support the contention that food is so significant to life.

Healthy Pastoral Peoples.

Delve into history and you will find that those races which have been nourished on dairy products always have been and still are the most vigorous and long-lived. Pastoral peoples the world over who have used liberal amounts of milk and its products have always displayed the greatest ability to survive the rigors, hardships, and privations of a precarious existence. As Professor E. V. McCollum of Johns Hopkins University has stated, " Wherever dairy animals are abundant in proportion to the population and their products form the staple articles of diet, fine physical development is seen without exception."

Further evidence of the beneficial influence of diet is afforded by the experience of those English colonists who came to North America in the early days. When the new nation was in the making in 1776 certain of these colonists chose to remain loyal to the mother country, accordingly some of them emigrated to Canada, and others went to the Bahamas. To-day the descendants of those settlers in the two places exhibit entirely different physical characteristics. The Canadians are an upstanding, virile people, but the Bahamians are more inclined to lead an easy, somewhat slothful existence.

An American scientist, Ellsworth Huntington, has suggested that the difference in the characteristics of these persons is due chiefly to climate conditions. It is true that the temperature of Canada is cold and invigorating, while that of the Bahamas is hot and enervating, but this is by no means the whole explanation, as Professor McCollum has pointed out. The Canadians have used a diet rich in milk, butter, cream and cheese, in addition to cereals, legume seeds, tubers, and meats. The Bahamians, on the other hand, subsist on fruits and certain vegetables, and seldom use dairy products. As McCollum says, " People will feel very different on these two types of diet."

If additional practical experience were

E.N.A.

A YAKUT GRANDMOTHER

A member of a hardy pastoral race—making butter in Siberia.

desired, certain conditions in India might be set forth. In a study of diets there, Dr. D. McCay found that the pastoral Indians were vastly superior in strength, health, and vigour to the other natives, whose rations were derived largely from the cereal grains. Dr. Robert McCarrison of the British Medical Service in India has reported isolated races in the Himalayas whose physique is magnificent and who preserve until late in life the characteristics of youth. These people live on a frugal diet, consisting mostly of goat's milk and vegetables, yet they are unusually fertile and long lived.

Many similar instances might be cited to show the beneficial effects of proper nutriment, especially with dairy products as the basis. Milk is the original food of the race and it is also the most nearly perfect of them all. It is, in fact, the only single article of the human dietary which contains practically every one of the elements which are necessary for the establishment and maintenance of good health. Scientists are agreed to-day that there is no other one substitute for milk, though there are, obviously, many other excellent foods which may be used in suitable combinations to produce a well-balanced diet. Milk should, however, form a part of the daily fare of every normal individual.

Milk the Ideal Food.

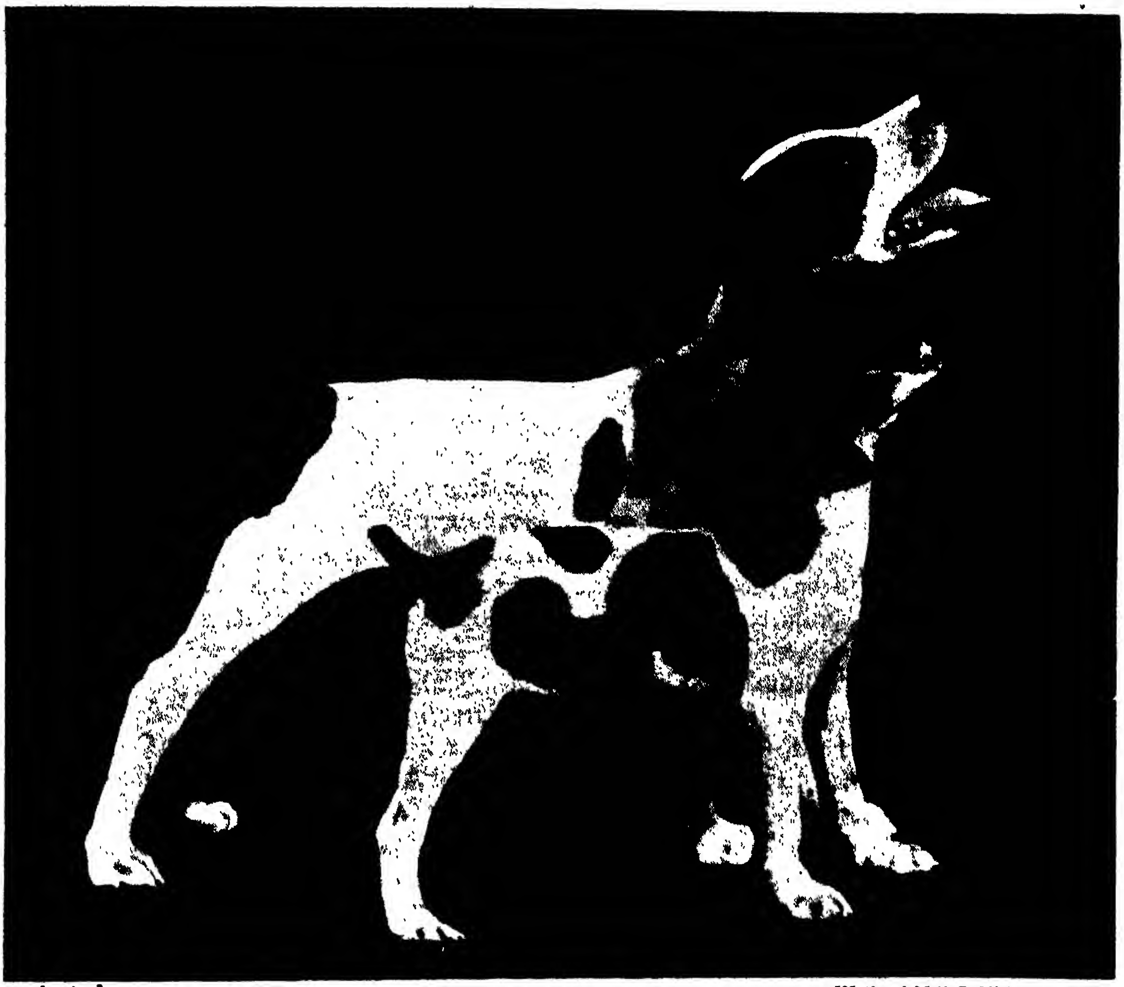
To support the assertion that milk is the most nearly ideal of our foods, there have been conducted and reported many interesting and conclusive experiments. Among the most notable have been those of Professor Henry C. Sherman of Columbia University, one of the world's leading investigators in the field of nutrition. In his laboratories in New York City, twenty-three generations of white rats have been raised on a diet of whole milk powder and powdered whole wheat. By augmenting the proportion of milk in the fare of these rats, their span of life can be extended and their vitality improved.

Experiments which have been confirmed over and over again by Professor Sherman have shown that by increasing the ratio of milk from one-sixth to one-third, there is more rapid growth, more efficient growth, somewhat larger adult size, greater vigour as indicated by earlier maturity, greater reproductive power, better survival, and much longer average life. It was found, for instance, that the animals fed on the lower amount of milk, which is considered adequate for general nutrition, lived on the average only 369 days, whereas those receiving twice as much milk lived for over 700 days.

The life of a white rat is relatively short, which is one reason why these docile rodents are so effective for observation or experiment. Translated into human experience, the 369 day life of the rat corresponds to 30 years of a man's life, and the 700 days is the equivalent of 60 years. But this is not the whole story. It was found that animals on a low milk diet showed a tendency to develop a lung disease at an age similar to that at which tuberculosis most often occurs in young adults. Other well-known investigators, such as Dr. F. C. Drummond in England and Professor H. Steenbock in Wisconsin, U.S.A., have likewise reported that a lack of vitamin A in the diet causes a susceptibility to respiratory infections.

Milk is plentifully supplied with this vitamin, since butter fat is the best source of it, with the exceptions of cod-liver oil and egg yolk. Milk is not only well-balanced with respect to the proteins needed to build and repair body tissue, the fats and carbohydrates necessary to provide fuel for the human machine, and the minerals which construct bones and assist in other bodily processes, but it is copiously supplied with all those accessory food substances, the vitamins, which are essential to growth, health, fertility, and favourable resistance to disease.

All of the six vitamins known in 1928 are to be found in milk, though in somewhat varying amounts. Vitamin A, which in many respects is the most important of these substances, is the most abundant. Vitamin B, which recent studies have shown to be certainly composed of two, and possibly of three, parts is also plentiful, both with regard to its growth and nerve-building factor and its anti-pellagra factor, now called vitamins



Courtesy] [National Milk Publicity Council

MILK MADE THE DIFFERENCE—I.

Two puppies from the same litter, the larger one was given milk every day after weaning in addition to its other food, the smaller one received none.

B1 and B2, respectively. The anti-scorbutic substance, vitamin C, is in milk, though it is somewhat easily reduced by heating. The anti-rachitic factor, vitamin D, is present in milk, undoubtedly in larger amount than has been credited by some writers. Finally, milk contains the anti-sterility substance known as vitamin E. This last named vitamin is not of great practical importance ; it is widely distributed in nature.

An eminent specialist in children's diseases once remarked that a rat is not a baby, and probably never will be. Properly planned and adequately supervised experiments with these laboratory animals will, however, produce important results which are unquestionably applicable to human experience whether it be the feeding of babies or of adults. There have been, moreover, tests with normal children which have yielded results confirmatory of those obtained with animals. A baby may not be a rat, but is is, nevertheless, also a member of the animal kingdom.

Daily Ration of Milk.

In order to ascertain what is the optimum amount of milk which should be in the daily diet of children, a study was undertaken in New York City by Professor Sherman in co-operation with the Association for Improving the Condition of the Poor, a leading philanthropic organisation. Twenty-one normal,

healthy children of various ages between three and thirteen years were selected and given various tests to determine the storage in their bodies of the important mineral calcium needed to form bones and teeth. Having determined the storage rate, a study was then conducted to indicate what amount of calcium, derived from different quantities of milk, gave the best storage. The third and fourth experiments in the series were made to find out whether children utilise the calcium from vegetables as well as that from milk.

The minimum amount of milk which should be in the daily diet of every child was determined to be not less than a quart, as a consequence of this important investigation. The results also revealed that the calcium from vegetables was not assimilated as efficiently as was that from the milk, a fact which does not necessarily detract from the value of vegetables, useful in the diet for many reasons, but does mean that vegetables should not be permitted to usurp the place of a liberal allowance of milk in some form.

Another study in which children were the actual beneficiaries was begun in 1919, by Professor McCollum, who found a negro orphan institution where the inmates were palpably malnourished because of improper food. The simplest way to improve the diet was to add milk to it, and so this was done by mixing Klim whole milk powder with water and feeding it to one-half of a group of 84 children kept under observation. The milk group immediately began to increase in weight, whereas those on the institutional diet showed no gain. After fifteen months the results of the milk diet were so striking that the children of the other group which had been used as a check were given a quart of reconstituted Klim a day, whereupon these children proceeded to grow during the next six months at rates comparable to those of the original milk group.

Such experiments with child feeding have not been confined to America, for recent studies on groups of children in Scotland have been reported in the *British Medical Journal*, for January, 1928. Under the auspices of the Scottish Board of Health, four groups of children were selected in each of seven towns, and each group, numbering from 40 to 50, was fed on a diet with a different amount of milk. Thus, the first set received their ordinary diet, the second had biscuit added to it, the third had separated milk added, and the fourth got whole milk.

From what has already been written, it is clear which group would show the best gain. As would be expected, those who had whole milk showed a rate of growth 20 per cent. greater than those who did not receive milk, and there was also an accompanying improvement in the general physical condition of the milk group. This study has evoked interest in the United States and was commented upon in the *American Journal of Public Health*, where it is editorially stated that, "The *British Medical Journal* makes the interesting comment, in comparing the children fed on biscuit with those taking extra milk, that the aggressive and dominant races have usually been those which consumed milk, while the docile and subject ones have used grain as their principal diet."

Thus has been proven again and again the inestimable value of milk as a supplementary food to compensate for deficiencies of other articles in the diet. McCollum calls milk and leafy green vegetables "protective foods" because of this very ability to supply what other viands often lack. Sherman studied over 200 American dietaries, both urban and rural, and came to the conclusion that more milk was necessary for the promotion of national vitality.

In the United States the consumption of milk has increased rapidly during recent years so that, in spite of the peculiar effects of the prohibition of more potent beverages which seem to have become increasingly popular as a consequence of that prohibition, milk is really the national drink. According to our federal department of agriculture the American people were in 1928 using almost half a quart of milk per person per day. Official and voluntary health agencies and dairy associations are carrying on active

Courtesy] [*National Milk Publicity Council*

MILK MADE THE DIFFERENCE—II.

These chickens, both of the same breed and the same hatch, were given all the grain they would eat, but the larger one received an additional daily ration of milk.

campaigns to increase this amount, and are apparently accomplishing their aims, for the people are gradually coming to realise the tremendous advantages to be gained from milk. No longer is this beverage looked upon as suitable merely for infants and invalids, but it is recognised as a staple food for all persons.

Along with the promotion of the wider recognition and use of milk there must, of course, be an accompanying movement for clean and safe milk. No food is more easily contaminated with the germs of communicable diseases than is milk, and innumerable epidemics have been traced to carelessly handled and polluted milk supplies. One of the most recent and startling of these outbreaks took place in Montreal, Canada, in the spring of 1927. Due to improper care of the local milk supply, there occurred some 5000 cases of typhoid fever, with approximately 500 deaths.

Because of the value of milk as a food and also because of the ease with which dangerous bacteria may gain entrance to it, health officials are assiduous nowadays in attempting to supervise and control milk supplies in the interests of the public health. A clean milk supply is one which comes from clean, healthy cattle, preferably tuberculin tested ; is produced by clean, healthy milkers, using sanitary methods ; is collected and shipped in sterile containers ; and is cooled immediately after milking and is kept cool in transit. Such milk should, as a result of these sanitary precautions, have a low content of bacteria, which is one of the best tests of its purity.

Ever since the time of the most ancient civilisation, milk has been an ally in the nourishment of man. The cow has frequently been worshipped as a goddess by peoples of the past, and rightly so, for when primitive man made friends with this beast he took the first step forward in human nutrition. Modern science has demonstrated that milk is worthy of the respect which has been accorded it from early times. It is the most nearly perfect of all our foods and as such deserves continuous and increasing popularity.

GOATS' MILK AS A PURE FOOD

By LINDA M. ENTHOVEN

Treasurer to the Sussex County Goat Club.

FOR many years a small group of believers in the great virtues of goats' milk as a food has done its utmost to encourage goat-keeping amongst all classes of the community, especially amongst cottagers, whose children rarely have as much milk as they should. The movement has, however, met with only a limited amount of success. The disinclination of the average person to take even a small amount of trouble to produce food, has always had to be contended with. It is so much easier to buy it in a shop.

Except for milk from the dirty, badly-kept goats in certain countries—for example, Malta and Gibraltar—it can truly be said that no safer or purer food exists than the milk of the goat, for goats are easily tended and easily kept clean. Goats' milk may, it is true, become infected with the disease germ causing Malta fever, and precautions have to be taken to ensure that goat's milk supplied to the troops in Gibraltar and other Mediterranean stations is free from this infection, but fortunately cases of Malta fever are so extremely rare in England that the disease may be classed as non-existent.

Value of Goats' Milk.

The value of goats' milk lies in its bacterial purity and its ease of digestion. Goats' milk very rarely contains the germs of tuberculosis, so that it is a safe food either for healthy or for tuberculous children. The ease of digestibility depends upon the minuteness of the fat globules, which are so small that cream never rises to the top of the milk, although the fat content, as can be seen from the table, is considerably higher than that of cows' milk. All milk curdles in the stomach, of course, because of the rennin in the gastric juice, but whereas cows' milk has a tendency to curdle into large, comparatively hard, lumps, goats' milk, because of the intimate mixture of the fine fat globules, tends to form small flakes of easily digested curd. In certain circumstances goats' milk can, however, give quite a tough curd, for which reason it must be cooked slowly when it is being used in milk puddings, etc. Goats' milk may sometimes have a slight taste and smell, caused by an acid peculiar to this milk, but if the animals are kept clean this taste and smell are so slight that it is questionable whether goats' milk would be recognised as such were the source of the milk unknown.

Another great boon to be obtained from the use of goats' milk, which is also due partly to the fineness of the fat globules, is that no child fed on it is likely to suffer from constipation, and it may, in fact, be a cure for obstinate cases of constipation, even if only used for a limited period.

The composition of goats' milk, as compared with human milk and cows' milk, is given below, arranged from the table on page 1346:

		COW	GOAT
Water ..	87.58	87.41	86.68
Protein ..	2.01	3.40	3.76
Fat	3.74	3.74	4.07
Milk Sugar ..	6.37	4.70	4.64
Mineral Salts	0.30	0.75	0.85

From this table it can be seen that goats' milk is very similar in composition to cows' milk, and, like the latter, contains considerably more fat and protein, but less milk sugar, than does human milk. Goats' milk is an admirable substitute for human milk, when a mother is unable to nurse her baby, but like cows' milk it must be diluted, or the baby will not be able to tolerate it. Goats' milk very similar in composition to human

milk is obtained by diluting the milk with one-third to half its volume of a 6 per cent. milk sugar solution. A 6 per cent. milk sugar solution is prepared by dissolving 2½ ounces of milk sugar in 2 pints of boiled water, or taking larger or smaller quantities of sugar and water in this proportion.

But how can one procure goats' milk? There is none on the market, and no demand to create a supply. One can only get it by taking a little trouble. In the past people have been inclined to make silly jokes about goats, to classify them as animals that any one can look after, and to have the impression that they produce gallons of milk with a minimum of food or attention. Consequently, the wrong people kept them, they were mismanaged, and in this way got the reputation of being difficult and tiresome.

[Topical

FRESH MILK FOR BREAKFAST
The safest milk for children, which can be produced very cheaply at home.

But there are thousands of people all over the country who could, and should, keep goats, with little trouble and small expense; people with a few acres of rough land, or with a good vegetable garden, people near commons and woods, and people with access to open land along our coasts. With care as to a sufficient supply of air, light, and exercise, and especially with a correct amount of fresh food, so that the milk will contain all the necessary elements, they can be kept in a well-ventilated stable and fed entirely in their stalls.

A good goat can easily produce from one to three hundred gallons of milk in the year, and as she can be fed to a great extent on food that no other animal cares for, the cost of the milk need not be more than half that of cows' milk, or even less. All outside leaves of vegetables, prunings of fruit trees or roses, clippings of hedges, everything comes as grist to the mill, and if kindly treated goats are most affectionate and interesting pets.

Several counties have goat clubs, affiliated to the British Goat Society in London (10 Lloyds Avenue, E.C.3.), and each of them has a keen secretary ready to answer any questions and to give advice to those who want to try to produce one of the most health-giving foods in the world. Little space is required, and although we cannot hope to see in England, as in Italy, 18 goats to the square mile, there should be many, many more than there are.

"YOGHOURT"

By DR. HAJJI SAAVA, Physician to the American Hospital, Constantinople.

"YOGHOURT" is as old as history; it has existed from time immemorial among nomads of the East. Every dialect from Caucasus to

the Persian Gulf, from Ararat to the Syrian Desert, from the Tarsus Mountains to the Mediterranean, from the Crimea to the Caspian Sea, from Pontus to Bosphorus, the Balkans and the Greek Isles, contains "Yoghourt" in its vocabulary. The Arabs call it "Leben," in the Crimea it is "Kotek," in Armenia "Matzoon," in Greece "Sonehidlk."

"Yoghourt" is curdled milk, soured milk, but every curdled milk is not "Yoghourt." It has to be curdled in a peculiar way by a special ferment. The bacteriology of the ferment is recent, but its virtue is as old as Isaac and Jacob, who all had sheepfolds and cowherds, and made milk cheese and "Yoghourt."

Prophets and kings of ancient time all ate "Yoghourt." There is not a village in the whole Orient where you cannot find "Yoghourt." And with bread and cheese, and eggs and wheat, it constituted the main article of food in the dietary of the Anatolian.

When "Yoghourt" is diluted with water and thinned out it is called "Airau," and is then the healthiest and most refreshing beverage in hot summer months for workmen who have to labour under the scorching sun out in the fields.

The grandeur and strength and endurance of the Turkish soldier, it may safely be said, are due to "Yoghourt" and the dietary cited above. The Turkish farmer and the Turkish soldier drink neither beer, nor wine, nor whisky, but eat "Yoghourt" and drink "Airau."

The late Professor Metchnikoff of the Pasteur Institute, Paris, knew that in Serbia and Bulgaria, where there were very many healthy old men, "Yoghourt" was a common article of food; he set himself to study it, and in a book which he wrote he extolled the virtues of this food.

The bacteriology of "Yoghourt" is known already. The ferment or yeast which curdles the milk is due to the association of three micro-organisms: *Bacillus Lacticus, Bacillus Bulgarensis,* and *Proteus Bacillus.* These three are not disease producing, but when introduced into the alimentary canal their presence hinders the growth of other putrefactive organisms.

Besides this beneficial action of the organisms themselves, the lactic acid formed from the curdling of the milk is by itself a powerful intestinal antiseptic. "Yoghourt," being milk, finally precipitated, is much more easily digested than plain milk, and of equal volume is more nutritious than milk itself.

It is a pity, speaking particularly about the therapeutic uses and medicinal actions of "Yoghourt," that its food value was lost sight of and that many people came to believe that it was an invalid food or an article of sick dietary.

It is true that "Yoghourt" is accounted a real panacea of diet in all forms of diseases. Almost any patient may eat it. In acute gastro-intestinal affections, in all forms of fevers and rash-producing diseases, in wasting diseases, in cirrhosis, in nephritis, and in phthisis, "Yoghourt" is freely prescribed in the countries where it is made.

Method of Preparation.

As to the preparation of "Yoghourt": take sheep's milk and boil it on a slow fire, as soon after milking as possible, care being taken to prevent burning or smoking. After the milk has boiled up well transfer to an earthenware vessel, which has just been well rinsed out with water. Place the earthenware vessel on a blanket (or thick layers of paper) which, after ferment is added, is wrapped round the vessel as an insulator, so that the final cooling stage takes place very gradually. Allow milk to cool until lukewarm. They test it in Bulgaria by sticking a finger into the liquid; when warmth of liquid is barely noticeable, it has cooled sufficiently. When cooled to this degree add the ferment, which consists of "Yoghourt" of the previous day. As to quantity of ferment, one dessert spoonful to a litre of milk is about right. The ferment, before adding, should be thinned with the warm milk to which it is to be added.

After adding ferment, stir milk well for a few seconds. Then wrap up the vessel in the rug, or the papers, and allow to stand two to three hours in a place free from any vibration. It should then be ready and should be

of the consistency of, say, a sloppy blancmange, and of specific sour taste. The length of time the milk is allowed to ferment I mention as two to three hours; while it is never less, it might be more. The length of time seems to vary, due possibly to the potency of the ferment, quality of the milk, or even weather conditions may have some effect upon it.

[E.N.A.

MILKING SHEEP IN THE HIMALAYAS
Sarikoli tribespeople milking their sheep for yoghourt—a staple food among nomads of the East.

It is best to eat "Yoghourt" 12-24 hours old. If it gets too acid, the acidity may be remedied by stirring it with a mixture of water and straining it through a cheese cloth. The excess of lactic acid goes away, and it is good to eat again by making it into a paste by adding water until it gets to a creamy consistence.

The Anatolian Turks have always at hand "Yoghourt" and serve it with meals, both as a dessert and as a dressing with many dishes, when they mix it, or not—according to individual relish—with garlic.

THE CEREALS AND THEIR PRODUCTS

By JOHN CAMPBELL, Ph.D.

THE cereals have from earliest times formed the most important sources of human dietary, yielding staple foods supporting millions of people in the temperate and tropical zones of the world.

The cereals belong to the natural order graminaceæ or grasses, and the edible varieties as we know them to-day have been evolved by natural selection and cultivation from wild plants.

The main edible cereals include:

Wheat	(Triticum vulgare)
Rye	(Secale cereale)
Maize	(Zea maidis)
Oats	(Avena)
Barley	(Hordeum)
Millet	(Panicum)
Rice	(Oryza sativa)

Up to within comparatively recent times the grains from these cereals have been used in their entirety either whole or reduced to meals by simple breaking and grinding processes, the edible products containing the germ and the integument of the seed. It is only within the last hundred years, especially in the case of wheat, that there has been an increasing tendency in modern roller milling to reject these parts of the grain in favour of the production of finer and whiter products from the kernel of the seed, the germ and integument being eliminated.

The various cereals differ from each other considerably in composition as the following table indicates:

Analyses of Cereals in their Natural Form
Showing percentage composition

	Water	Protein	Fat	Carbo-hydrates	Cellulose and Fibre	Ash
Wheat ..	12.0	11.0	1.7	71.2	2.2	1.9
Oats ..	10.0	10.9	4.5	59.1	12.0	3.5
Oats (milled)	6.9	13.0	8.1	68.6	1.3	2.1
Rye ..	11.0	10.2	2.3	72.3	2.1	2.1
Maize	12.5	9.7	5.4	68.9	2.0	1.5
Barley	12.3	10.1	1.9	69.5	3.8	2.4
Millet	12.3	10.4	3.9	68.3	2.9	2.2
Rice (in husk "paddy")	10.5	6.8	1.6	68.1	9.0	4.0
Rice (husk removed)	12.0	7.2	2.0	76.8		

The proteins present generally include glutenin, gliadin, aleurone, legumin and vegetable albumin. The edible carbohydrate present is mainly starch with small quantities of sugar. The ash is mainly composed of compounds of calcium, sodium, potassium, magnesium, and iron in combination with phosphoric, sulphuric, and hydrochloric acids.

In addition, lipoids (phosphoric acid in organic combination) are present. The vitamins present in cereals are A, B and D, mainly found in the germ and integument of the grain. Vitamin C is absent, or only present in traces in cereal grain, but on germination it is elaborated *pari passu* with the development of the embryo.

Viewed from the standpoint of staple foods, the cereals are deficient in protein and fat. This is well seen in the following approximate comparative percentage table:

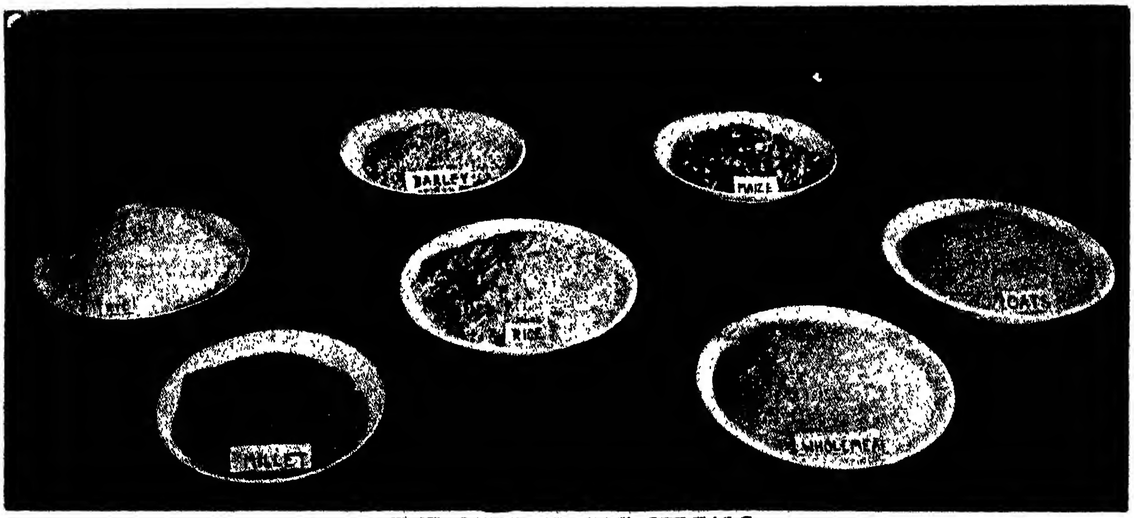
	Standard Percentage Diet in 24 hrs.	Oats	Wheat	Rye	Barley	Maize	Rice
Carbohydrate ..	66	67	71	72	70	69	68
Protein	20	13	11	10	10	10	7
Fat	14	8	2	2.5	2	5	1.5

The cereals and their food products generally, therefore, require to be supplemented with protein foods in the form of flesh, fish, milk and milk products, eggs, nuts, butter, margarine, oil or other fatty compounds.

Not only, however, is there a deficiency of total protein in cereals, but the cereal proteins themselves are not "good proteins." The amino acid bases are not in suitable proportions for economical reconstitution into human flesh, and in some cases, as in the zeins of maize, essential amino acid constituents are actually absent.

In "gliadin" for example of wheat, there is a notable surplus of glutamic acid, and a big deficiency of lysine. In order to reconstitute one gram of human muscle protein, forty grams of gliadin would be required.

When maize forms the bulk of a dietary, and therefore is also the chief source of nitrogen, the incomplete amino acid constitution of the proteins contributes to the



THE CHIEF EDIBLE CEREALS

onset of the disease known as pellagra. Of the cereals, the proteins of rice have the highest biological value.

Cereal proteins are thus to a certain extent wasteful and should be supplemented with a certain proportion of animal protein.

The researches of Professor and Mrs. Mellanby appear to establish the fact that the germ of cereals (especially oats) contains toxins that have a retarding effect on the development of the bones and teeth, and favour the onset of rickets. This deleterious action, however, is completely nullified when the cereal foods are eaten with a due allowance of other foods like milk, cream, butter, animal fat and eggs that yield vitamins A and D. As the cereals comprise over 50 per cent. of our daily dietary it is most important always to serve porridge and other breakfast cereal foods, especially in the case of children, with milk, cream or butter, and to include eggs generally in the weekly diet.

WHEAT

Among the cereals wheat holds the premier position, on account of its wide distribution and its unique properties as a bread producer.

The structure of the wheat grain is illustrated on this page and on page 25.

The wheat grain is made up of:

(1) An outer coat (the bran) forming a protecting covering (13.5 per cent. of the seed).

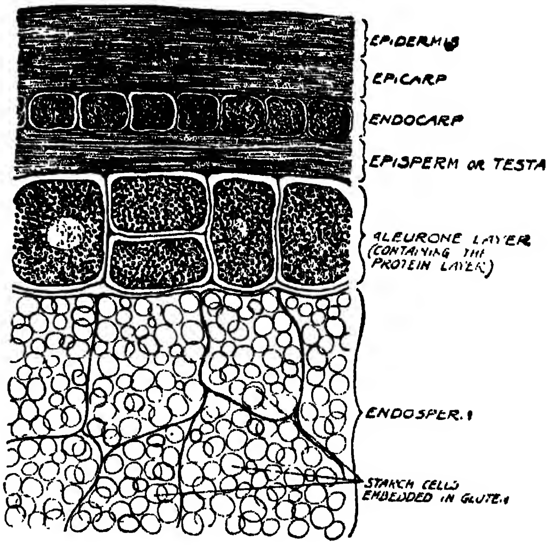
(2) The endosperm forming the body of the grain (85 per cent. of the seed).

(3) The germ or embryo proper, a small nodule lying towards one end (1.5 per cent. of the seed).

The bran consists of fine layers:

(a) Epidermis	-	Envelope of Grain
(b) Epicarp	-	(Cellulose and fibre)
(c) Endocarp	-	
(d) Episperm	-	Envelope of seed proper (Phosphates, vitamins and protein colouring matter)
(e) Aleurone Layer	-	
(f) Endosperm	-	(Starch and gluten)

The germ is composed of cells possessing latent vitality. Under suitable conditions of moisture and temperature in the soil, these cells awake to activity and growth, initiating the production of a new plant.



THE STRUCTURE OF WHEAT GRAIN
A highly magnified section showing the complex structure of the bran, and the endosperm or inner portion from which white flour is obtained.

The endosperm consists of starch cells lying in a fine mesh of gluten and cellulose. These food constituents are slowly dissolved by the digestive ferments produced in the cells of the germinating embryo, and used as food until such times as the plant has developed sufficiently to derive the nourishment it requires from the soil and air.

These structures differ very widely in chemical composition.

ANALYSES OF GERM, BRAN AND ENDOSPERM*
Showing percentage composition

	Bran	Endosperm	Germ	Whole Wheat
Water	12.5	13.0	12.5	12.0
Protein	16.4	10.5	35.7	11.0
Fat	3.5	.8	13.1	1.7
Carbohydrates ..	43.6	74.3	31.2	71.2
Cellulose and Fibre	18.0	.7	1.8	2.2
Mineral Matter ..	6.0	.7	5.7	1.9
Organic Phosphates (Lipoids)	Present	Trace	Present	Present
Vitamins	A.B.	Trace	A.B.D.	A.B.D.

The germ and bran contain the organically combined phosphates and vitamins A, B, D, but the endosperm only contains traces of these bodies.

The germ is the most nutritious structure of the grain, having a high protein (tissue

* *Food and Dietetics*, Robert Hutchison.

WHEAT GRAIN BEFORE CLEANING
A handful of wheat direct from the farmer. There is some foreign matter in the bulk, though it is difficult to see it.

and cell producing) and fat content, and a low percentage of starch, in contradistinction to the endosperm, which is low in protein and rich in starch.

The bran has a high percentage of cellulose and fibre, forming the indigestible roughage of the berry, and is rich in mineral phosphates. The proteins of the endosperm are grouped under the general term gluten. Gluten does not exist as such in the grain, but is formed when the wheaten proteins are treated with water. The two principal gluten proteins are gliadin and glutenin, insoluble in water, with small quantities of soluble albumen and globulin. The gliadin and glutenin give tenacity, stability and elasticity to flour doughs, the gliadin being the more important factor, and the value of a cereal for bread-making purposes may be generally referred to the percentage of gliadin present and its ratio to the glutenin content.

Of the cereals, wheat contains the highest proportion of gliadin and so stands pre-eminent for bread-making purposes. Maize, barley, oats and rye are deficient in gliadin, and so are not capable of forming a dough with sufficient tenacity and elasticity to produce a well-vesiculated loaf.

Milling Products. The earliest milling processes producing simple grades of flours were accomplished by stone-grinding. The wheat, after preliminary grading and the removal of foreign ingredients, is cleaned and fed through the centre of the upper mill-stone to the grinding revolving surfaces, and is extruded at the periphery. The character of the grinding surfaces and the distance from one another at which they are set determine the character and fineness of the finished products. By stonemilling it is possible to obtain absolute wholemeals by the one operation, or the final wholemeal may be separated by graduated sieving and bolting processes into two or three streams representing one or two grades of more or less white flour, and offal consisting of the bran and germ. Various portions of the products may be returned to the stones for fine grinding.

Stonemilling processes are thus simple and few, and the white flours do not reach the

REVEALED IN THE CLEANING PROCESS—I.
Some of the most surprising samples of rubbish—pieces of wood, coal, wire, other kinds of grain, etc., found in the apparently not very dirty wheat.

extreme fineness and pure white colour that characterise the patent flours produced by the modern roller mill process.

Stone ground white flours contain parts of the inner coats of the bran, and portions of the germ. These flours are more nutritious than roller patent flour and produce generally a better flavoured though a darker loaf.

On account of the presence of bran and germ, stone milled flour does not keep so well as patent flour, and in the process of doughing the ferments present soften the gluten so that it is more difficult to produce well vesiculated bread. Modern stone mills are, however, still well adapted to produce wholemeals, there being no need for elimination processes.

Roller Milling.

In the roller milling process the wheat grain is reduced to flour and offal by a series of breaks and reductions effected by steel rollers.

The wheat is first subjected to a number of mechanical processes in special machinery whereby stones, dirt, foreign grains, cockles, and other extraneous bodies are removed. The grains are then washed and dried, and passed to the first rollers for milling. There are usually four, and consist of fluted steel rollers, revolving at differential speeds, at suitable distances apart. These rollers are termed "breaks," and in effect break the grains into several coarse products, which are separated by suitable sifters. One product is semolina, small translucent particles of the endosperm which are passed to the smooth reduction rollers for the production of white flour, each successive stage separating a finer and whiter flour as the main product.

There is thus an advancing residue which becomes during the process whiter and finer until finally a pure white flour is obtained derived solely from the central portion of endosperm. In the highest grade patent flour the gliadin and glutenin are in well-balanced proportions, and this quality, combined with the absence of ferments, ensures the formation of a very tenacious and stable dough. The lower grades of white flour contain parts of the kernel lying nearer to the bran and are appreciably darker.

Photos, Courtesy] [*Allinson Ltd.*

REVEALED IN THE CLEANING PROCESS—II.

A much later stage in the cleaning process—even the smallest particles of dust are shaken and sifted away from the wheat.

This end flour is finally dressed by passing into revolving drums provided with internal beaters and covered with fine silk—100 to 180 meshes to the square inch. The finest particles of the flour are forced through the silk leaving the coarser portion to be returned to the rollers for further reduction.

This product forms the high grade patent flour generally used in the production of white bread, and represents the inner part of the endosperm, producing a very bold loaf, characterised by a fine bloom and texture, but inferior in nutritive value to the coarser flours or wholemeal.

At various stages of the milling, parts of the bran and the germ are eliminated, being utilised in poultry, pig and cattle feeding. The germ and bran are eliminated for technical reasons connected with the keeping and baking qualities of the flour. If the raw germ is retained the flour is apt to turn rancid owing to the decomposition of the germ fat. Certain ferments (enzymes) are also present in the bran and germ which soften the gluten, and lower its cohesion and elasticity.

This necessitates a closer attention to the doughing state of bread-baking in relation to the time that it should be "taken" for the purpose of weighing off and moulding into loaves. The softening action tends to produce a smaller loaf of close texture.

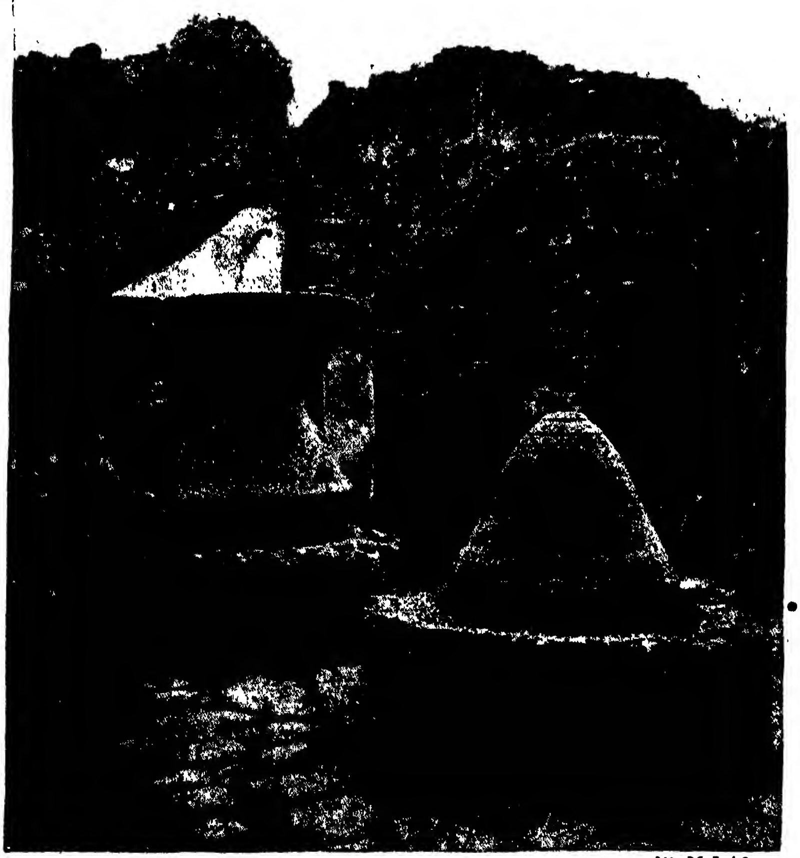
The products or "streams" from the various breaks and reductions are very numerous, and may be used singly or blended in various ways at the discretion of the miller or they may be reassembled in proper proportion to form a wholemeal.

Bleaching of Flour.

The popular predilection for very white bread of very even texture is from the dietetic standpoint rather unfortunate, for nutritive value is sacrificed to æsthetic considerations. To meet the public and trade demand for such flours, many millers have recourse to bleaching processes.

For this purpose, acid phosphates of calcium, ammonium persulphates, peroxide of nitrogen, nitrogen trichloride, benzoyl peroxide, and chlorine are employed. These chemicals exert an oxidising action on the dark constituents resulting in a notable blanching of the flour. Electricity is also used in conjunction with air, whereby oxidising gases in the form of ozone and oxides of nitrogen are produced. The flour is subjected to the action of the ozonised air for a few seconds in an agitator and emerges considerably lighter in colour.

The Ministry of Health report on this practice does not commit one to the view that these processes as carried out are harmful, yet from the dietetic standpoint they are entirely unnecessary.



[D. McLeish

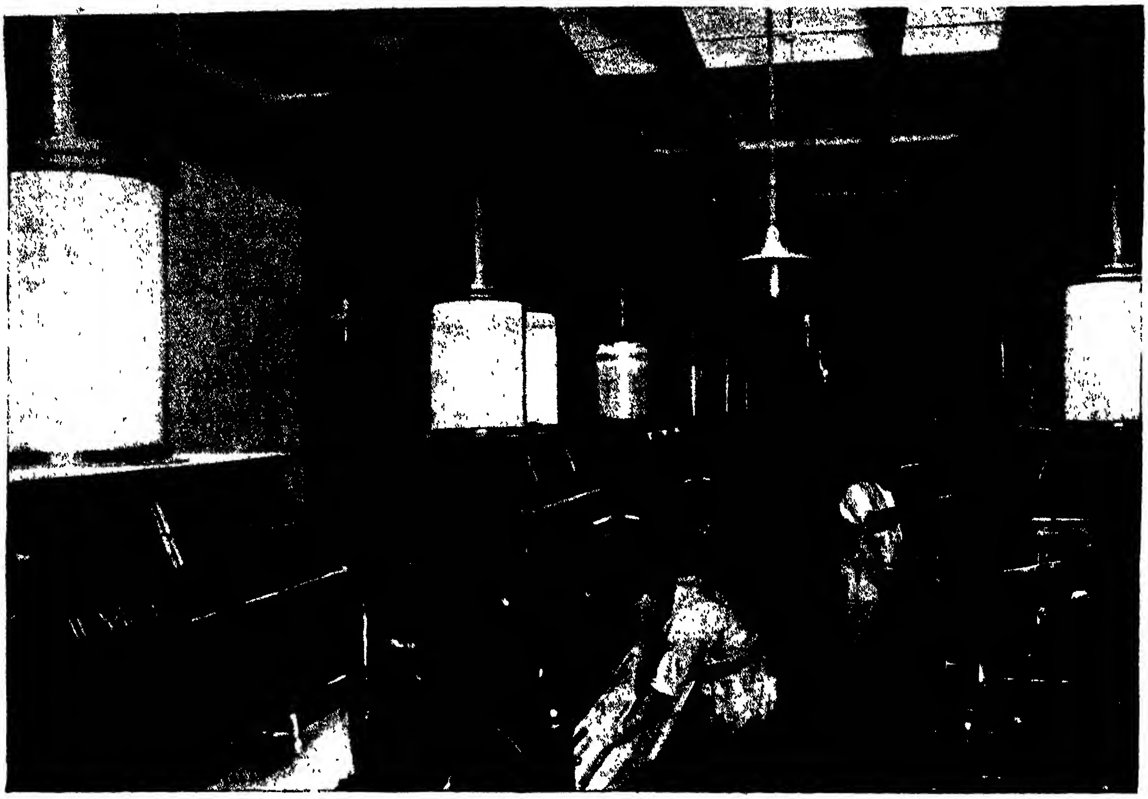
AN ANCIENT FLOUR-MILL

The remains of a bakery at Pompeii; the wheat was ground into flour on the stone mills (turned by slaves or asses) in the foreground, and bread was baked in the ovens built in the far wall.

OTHER WHEATEN PRODUCTS

SEMOLINA is usually prepared from the hard wheats (Triticum durum) and represents granules of the endosperm milled by special rollers. The bran is removed before milling and the roller product sifted so as to separate the semolina granules. It has a higher protein content and contains less starch than flour, and is extensively used for milk puddings and for addition to certain soups.

MACARONI is also prepared from hard wheat. The grains are milled and sifted to separate the glutinous endosperm fragments from the starch. These are then reduced to flour by further milling processes.



[Keystone

A MODERN ROLLER MILL

The process by which many modern factories grind their flour—in contrast to the ancient stone milling method.

The gluten flour is mixed with water to form a dough, and drawn and moulded by machinery into the familiar tubes of commerce.

Macaroni contains very little waste material and when properly cooked is, according to Rubner, entirely digested and absorbed in the system. A recent advance is the preparation of the Monte Rosa *wholemeal* macaroni, giving all the dietetic advantages of the whole grain.

Macaroni is commonly combined with cheese or tomatoes, making savoury dishes, which possess a high nutritive value and make excellent substitutes for meat courses.

VERMICELLI is prepared in its initial stages exactly in the same way as macaroni, but it is moulded in thinner forms and is solid. Like macaroni it is digested and absorbed in its entirety. Both macaroni and vermicelli contain more protein and less starch than flour.

AVERAGE ANALYSES OF MACARONI, VERMICELLI AND SEMOLINA*

Showing percentage composition

	Semolina	Macaroni	Vermicelli
Water	10.0	12.0	10.0
Protein	12.0	11.0	12.0
Fat	.7	.8	.7
Carbohydrate ..	76.2	75.2	76.2
Cellulose ..	.5	.3	.3
Ash	.6	.7	.8
	100.0	100.0	100.0

WHEAT FLAKES.—There are many preparations of wheat on the market in the form of flakes, granules, or shreds, forming very useful breakfast foods. Usually these products are pre-cooked and partially dextrinised, so that they are ready for consumption by the addition of hot milk. Their nutritive value is much greater than white flour produce and, when prepared from the whole grain, they contain the useful roughage

* Balland, *The Analyst.*

so necessary to healthy bowel action, as well as vitamins A, B and D.

Recently whole wheat has been prepared on the lines of Swedish Rye Bread. The preparation takes the form of oblong porous cakes, breaking crisply in the fingers and teeth. The wheat is pre-cooked before preparation, thus ensuring the bursting of the starch cells and the softening of the bran.

This form of whole wheat presents a highly concentrated and digestible food with a full complement of cereal vitamins ; it favours thorough mastication and salivation. The analyses of most of these products approximate to that of whole wheat. In some cases a small proportion of vegetable fat is incorporated which raises the caloric value.

BISCUITS.—Wheaten meal and flour enter wholly or largely into the formulæ of many varieties of biscuits, and these foods give welcome variety in digestible forms to the cereal ration of our daily dietary. The water content is low so that they represent highly concentrated cereal foods ; in the crisp condition they induce complete mastication and salivation of the food bolus before swallowing. Usually there is more or less dextrination of the starch, the degree depending on the baking temperature and the time to which they are exposed in the oven to thermal action. The percentage of cellulose (roughage) and vitamin depends on the proportion of wholemeal used in the formula and the temperature to which the biscuits are subjected.

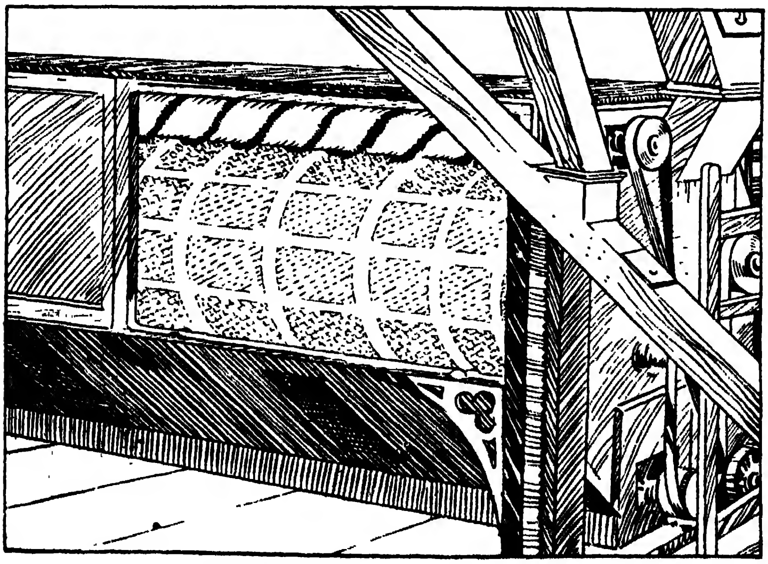
The caloric value and protein content of biscuits is increased in many varieties by the addition of other ingredients in the form of milk, egg, sugar and fat.

MAIZE (INDIAN CORN)

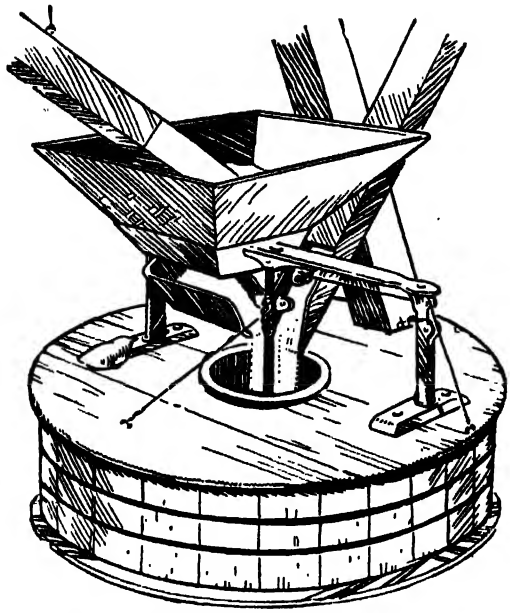
After wheat, maize is the most important of the cereals and forms a staple food in Africa and America. It is also used to a limited extent in Europe

The analyses given on page 1364 show it to be the second richest in fat, but the protein and mineral content is low. The gluten proteins are absent in maize, but it has some agglutinating properties, though not sufficient to produce an ordinary vesiculated bread, the chief proteins being zeins and globulins of low bio-chemical value. For this reason bread and other baked maize foods are generally unleavened and take the form of flat cakes, and do not present the light even texture of wheaten bread. The sweet maize (Zea saccharate) is cooked and eaten in the green stage in its entirety and forms a most palatable and digestible fresh cereal food.

The milling products include corn meal, cornflour, hominy and polenta. Corn meal may be either white or yellow, with equal nutritive value according to the variety of maize from which it is prepared. The meal is milled from grain after removal of the outer coarse bran. The preliminary milling processes break up the grains into a coarse product, from which the hull and germ are removed by



HOW WHOLEMEAL IS MADE—I.
The centrifugal machine which rejects all flour not up to the standard of fineness and returns it to be re-ground.



HOW WHOLEMEAL IS MADE—II.
Wheat passing through a shoot into mill-stones to be "stone-ground."

sifting and a strong air blast. The residue is then ground by grooved steel rollers and after further sifting forms the corn meal of commerce, representing about 70 per cent. of the seed.

The meal is granular in character and forms the basis for the preparation of maize foods. The fat soluble vitamins are present, but it is doubtful whether it contains vitamin B.

The corn meal prepared by stone milling, known as "soft" meal, is much coarser than the granular roller milled meal, and contains more of the germ and bran. It is extensively used for bread-making in the form of unleavened flat cakes. It has a higher fat soluble vitamin value and contains a measurable vitamin B content, and a notable proportion of roughage.

Cornflour is prepared from fine maize meal by washing with alkaline solutions which remove the protein and fat. It represents the purified starch of the maize grain. Except as a source of starch, its nutritive value is low, as it contains no vitamin and only traces of phosphates. It forms the basis of many custard, egg and blanc-mange powders.

Hominy is the equivalent of wheaten semolina and merely consists of the grain broken down to a degree of fineness suitable for the preparation of milk puddings.

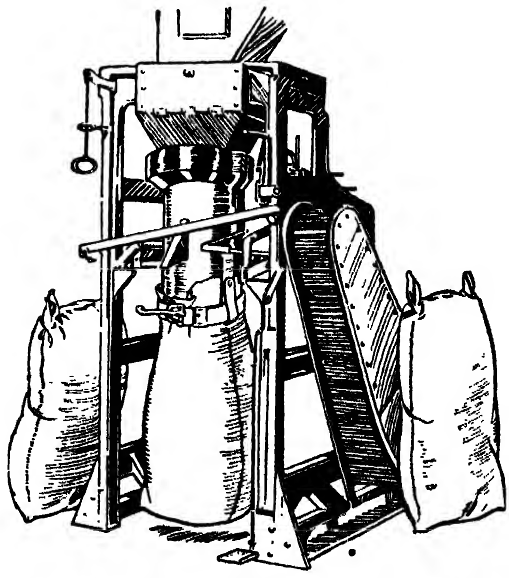
Maize meal to the extent of from 5 to 10 per cent. is sometimes employed in conjunction with wheaten flour in the manufacture of bread. The inclusion results in the production of a loaf containing rather more moisture than ordinary bread, and having a lower nutritive value. Whole maize is eaten in the form of "pop corn" prepared by roasting the small hard grain of the Zea everta. During the cooking the grains are burst, and the starch cells softened. Pop corn is a nutritious food and has the advantage of presenting a full vitamin content.

Maize is a nutritious and digestible food, and on the ground of economy alone should find an increasing consumption in our homes.

Analyses of Cornmeal, Cornflour, Hominy and Popcorn

Showing percentage composition

	Cornmeal	Cornflour	Hominy	Popcorn (after cooking)
Water	14.0	14.0	12.0	4.5
Fat ..	1.0		.5	5.0
Protein	7.0		8.0	11.5
Carbohydrates	75.5	85.7	78.5	75.7
Cellulose	1.5	---	.5	2.0
Ash	1.0	.3	.5	1.3
Vitamins	A sometimes B	None	A	A & B



Drawings, Courtesy] [*Allinson Ltd.*

HOW WHOLEMEAL IS MADE—III.
Filling the sacks with the finished product, and weighing them at the same time.

RYE

Rye is extensively used for the purposes of bread-making, and forms the staple food and is largely consumed in many European countries (Sweden, Holland, Belgium, Germany, Austria and Russia).

Rye is distinguished from other cereals by its high proportion of soluble proteins, which act as dissolving ferments on the starch and insoluble proteins. For this reason it is largely used in the brewing and distilling industries in the preparation of their seed yeasts, as the products of the fermentative activity are excellent yeast foods promoting cell growth. It is used sometimes in this country by bakers for this purpose in the form of ferments.* The gliadin and glutenin are not in well-balanced proportions so that rye flour yields little gluten and does not form a tenacious dough.

Rye bread is thus of close, heavy texture and the loaves are small and moist. In Sweden much of the rye bread is made in the form of crisp oblongs, from practically whole rye meals. This form of rye bread is much more palatable and digestible than ordinary fermented rye loaves, and is now finding a considerable consumption in this country. This crisp rye bread forms a welcome addition to our cereal dietary.

Rye flour varies very considerably in its physical characters and composition according to the efficiency of the milling and sieving processes. The finely milled and bolted rye flour makes the lightest bread, and, from the digestible standpoint, the best. As flours approach the wholemeal standard the bread becomes darker. Wholemeals produce very dark brown bread, as for example pumpernickel, the common bread of the peasants of Northern Germany.

OATS

Oaten preparations constitute a very valuable part of human dietary. In the form of flakes, groats or meal, and served as porridge or dry and eaten with milk, butter or cream, they are favourite breakfast and supper foods.

* See "Bread and Bread-making."

The oat grain is rather different in its structure from most other cereals, and requires to be most carefully prepared for milling purposes. The husk is very tough and very adherent to the actual seed, and special treatment is necessary before it can be removed. The integument of the seed itself bears short spinous hairs, which are usually removed before grinding.

In the preparation of oatmeal the husk and bran are removed, with or without germ, the decorticated seeds forming the groats. In some oatmeals the germ is retained while in others it is eliminated. The fineness of the meals depends upon the preliminary treatment of the grain, *i.e.*, whether used in its entirety with the husk, or decorticated.

The finest oatmeals are like the white wheaten flours, the products of the endosperm. The latter meals naturally contain far less roughage than those milled from the entire grain in its husk. In addition to the fine, medium and coarse oatmeals, oats are presented as food in the crushed form as flakes under numerous proprietary trade marks. Often these oaten flakes are precooked by wet or dry heat or both, so that they require very little kitchen cooking to prepare them for the table. Oatmeals are very nutritious foods, and when properly cooked are reasonably digestible.

Raw oatmeal requires long and very careful cooking, otherwise the enveloping cellulose cells remain hard and unbroken, locking up the nutritive elements from the action of the digestive juices.

In some people oaten foods tend to produce skin eruptions. The cause is obscure, but is probably a dietetic idiosyncrasy in the person concerned. In such cases they should be cut out of the diet.

Oats are also largely utilised in food in the form of oat cakes. The water content is low so that they represent highly concentrated cereal nutriment. In Scotland "brose" is also served consisting of raw oatmeal scalded with boiling water or milk and eaten with added butter.

In nutritive value from all dietetic standpoints oats stand the highest among the

cereals. Vitamins A, B, D are present, and the ash is rich in phosphates. Parts of the phosphates are organically combined in the form of lipoids.

The protein content consists chiefly of a particular form of vegetable myosin resembling in its properties the legumine of the pulses, and is well digested and absorbed up to 95 per cent. There is only 4 per cent. loss in the assimilation of its carbohydrates and 7 per cent, in the fat.

As a breakfast food it is pre-eminent especially in the forms approximating to the wholemeal standard, replacing part of the white bread ration by an equivalent food rich in phosphates with a higher protein content, and yielding a notable proportion of necessary roughage.

[Keystone

HARVEST TIME

Among the oat sheaves—destined for consumption in the form of porridge, oat-cakes, and "digestive biscuits."

ANALYSES OF OATEN FOODS

	Oatmeal (Fine)	Oatmeal (Coarse)	Groats (Prepared)	Flaked Oats
Moisture	9.5	9.0	10.5	7.5
Fat	9.0	9.0	6.5	6.5
Protein	15.5	12.0	11.5	14.5
Carbohydrates	61.0	64.0	67.7	66.0
Cellulose	3.0	3.5	2.0	3.5
Ash	2.0	2.5	1.8	2.0
	100.0%	100.0%	100.0%	100.0%

BARLEY

Barley does not occupy a very prominent position in human dietary being chiefly grown for malting purposes for the production of malt extract and sweet worts used in the production of beer and spirits. Barley is seldom milled for food purposes, being used in the grain form chiefly in the preparation of soup, stews and casserole cookery.

Barley is poor in protein and with the exception of rice contains least fat of the cereal foods. On the other hand it has the highest percentage of mineral constituents.

Barley meal proteins do not form a good gluten and it is thus unsuitable for bread making purposes. Gliadin and glutenin are absent, but their places are taken by the protein hordein, and another insoluble protein, which have similar properties.

The edible forms of barley are Pearl Barley, Scotch Barley and Barley Meal.

PEARL BARLEY consists of barley from which the husk and bran have been removed and the grains subsequently polished.

SCOTCH BARLEY resembles pearl barley but contains a higher percentage of the bran.

BARLEY MEAL is milled from grain from which the husk has been removed in various

grades of fineness. The Pearl and Scotch barley being in the form of a huskless whole seed, require prolonged cooking in order to render them digestible by softening the cellulose and gelatinising and bursting the starch grains. Being ingested mostly in soups, broths, and stews they generally escape mastication and are in that condition only very slowly reduced by the digestive juices, a considerable percentage being excreted undissolved.

Dry Malt.—In the preparation of malt the barley grain is allowed to germinate in the malting house at a temperature of 50°-54°F. During this growth the cells of the germ produce a ferment known as diastase, which has the power of converting starch into dextrine and malt sugar. This conversion goes on during the whole period of malting. If allowed to proceed to finality the entire sugar produced would be used by the developing plant as food. To prevent this the maltster arrests the germination by raising the temperature and drying. While this kills the germ, it leaves the diastase uninjured.

The dried malt is ground into meal and is used largely by bakers in the preparation of malt bread. In the preparation of malt extract the ground malt is extracted with hot water and evaporated to the proper consistency *in vacuo* at a temperature not exceeding 125°F. Malt extract is chiefly a source of pre-digested carbohydrates in the form of dextrine and malt, cane and invert sugars. In addition it yields over 6 per cent. of protein. Malt extract usually contains active diastase, and thus exerts a digestive action on the starch of our foods when taken after food or with a meal as a sweetener of the farinaceous dishes.

Analysis of Average Malt Extract

	Per cent.
Water	23.0
Protein	6.5
Maltose	44.0
Invert Sugar Dextrose and Lœvulose	14.0
Cane Sugar	3.5
Dextrin	7.5
Ash	
	100.0

Malt extract forms an admirable vehicle for taking cod-liver oil and certain tonic compounds. The malt extract renders the oil more palatable and digestible and reduces nausea. Added to milk it induces the formation of a fine soft curd thus increasing the digestibility. Used as a sweetening agent for cows' milk in infant feeding it lessens the liability to regurgitation.

Barley Water is prepared from pearl barley by boiling it in water and draining. The liquor contains small quantities of starch, protein, sugar and mineral matter with flavouring bodies. It has little nutritive value, but forms a soothing beverage for sick people, especially if slightly sweetened and flavoured with lemon juice. It is an excellent diluent of cows' milk, breaking up the curd and rendering it more digestible.

RICE

Rice forms the staple food of many Eastern countries and though poor in protein, fat and salts, it is well adapted to meet the requirements of tropical dietary, when supplemented with fish and other protein foods.

Rice foods are usually prepared from the whole grain, only a comparatively small quantity being ground to form semolina or flour. The preparation for culinary purposes is simple, the husks being merely removed from the seeds (unpolished rice). Sometimes the grain is subjected to a further polishing action which removes the integument and germ (polished rice). The polished rice is much whiter than the natural seed, and is the form in which it is chiefly imported into this country.

Rice semolina is the grain milled to a granular consistency, and ground rice the fine flour produced by further reduction. Rice is also marketed in the form of precooked flakes by soaking, steaming, and pressing between hot rollers. In the process part of the starch is dextrinised and the preparation is more digestible than the raw grain.

Rice flour does not form gluten and so is not suitable for bread-making, though small quantities may be incorporated with wheaten

PREPARING FOR THE MAIZE HARVEST [Keystone

A field of young maize or Indian corn in America, where it is used extensively for food.

flour for that purpose. The rice proteins amount to only 6 per cent, but biologically they are of good quality.

Rice contains very little cellulose, the starch granules lying free. On this account the carbohydrates of rice are very accessible to the action of the digestive ferments, and are completely absorbed. Whole rice contains the fat soluble vitamins and also vitamin B. The latter vitamin is mainly found in the pericarp, sub-pericarp and germ, and is eliminated during the process of polishing.

For this reason the darker unpolished rice is a far more valuable food than the polished kind. This is proved by the fact that when polished rice forms the staple food of the people the disease beri-beri develops, due to the absence of vitamin B, but is never seen in districts where the people eat the natural grain in its entirety. In European countries rice is very seldom served as a plain boiled dish, except in the preparation of curries. Usually it is used in conjunction with milk and eggs and butter to make baked puddings. In this form the deficiencies of the rice in protein and fat are made good by the additional food factors. Ground rice is also mainly used in a similar way.

MILLET

Millet is a staple food in Africa and the countries of the Far East, and is grown also in Southern Europe. It is not used to any great extent in the British Isles. In nutritive value it stands between wheat and rice, and though it lacks glutinous properties it is used by the natives in the form of bread, and also in conjunction with milk in the form of puddings. The addition of milk corrects the deficiency in protein and fat.

The whole grain contains the fat soluble vitamins and also vitamin B.

India millet (Sorghum vulgare) belongs to a different species, but has a similar composition to the Panicum setaria, and is used as food in the same way.

FARINACEOUS FOODS

These foods include sago, tapioca, arrowroot and their preparations, and may be conveniently considered here.

SAGO is derived from the pith of the sago palm and may be regarded simply as palm starch. The sago of commerce is marketed in the form of hard semi-translucent granules.

The granules are tough and hard, and generally keep their shape on cooking. Sago contains only traces of protein fat and mineral matter, and on this account is of low nutritive value, except as a source of starch.

Sago is mainly used in conjunction with milk, eggs and butter in the form of baked pudding, and this combination forms a nutritious and well-balanced food. It is also useful as an addition to certain soups. Vitamins are absent.

TAPIOCA is prepared from certain roots and may be regarded as root starch. The roots contain in their natural state traces of prussic acid and possibly other poisons which are dissolved out by water from the root pulp before manufacture into the edible produce.

The crude tapioca (Fecula) is sun-dried and reduced to powder. A paste is then formed by mixing with water, and is forced through a sieve, yielding rough nodules. A variation of this simple method is to heat the sun-dried fecula on hot plates during which process the cellulose cells are burst, and small nodules are formed by glutenation of the starch cells. Like sago it contains only traces of protein and fat. Its nutritive value and culinary uses are identical with those of sago. Vitamins are absent.

ANALYSES OF SAGO AND TAPIOCA

Showing percentage composition

	Sago	Tapioca
Water	14.0	13.0
Fat	.2	.2
Protein	—	—
Starch	85.7	86.4
Ash	.1	.4
	100.0	100.0

CUSTARD AND BLANC-MANGE POWDERS

These preparations have for their foundation starch in some form tinted with harmless vegetable colours. In their simplest form they contain only traces of protein and consist entirely of starch. Egg powders are usually devoid of the genuine article and by recent food regulations must bear an intimation to that effect. They contain small proportions of protein (albumin or casein) and in this respect have a higher food value than the custard powders. Most of the egg powders also contain aerating chemical compounds (soda, tartaric acid, etc.) These substitutes have very little nutritive value and cannot compare in the slightest degree with custards made from eggs and milk.

Usually these powders are made up with milk, the food value thus being considerably enhanced. Some custard powders contain dried milk and these have a considerable nutritive value.

ANALYSES OF TYPICAL CUSTARD AND EGG POWDERS

Showing percentage composition

	Custard Powder	Blanc-mange Powder	Egg Powder
Water	12.0	11.0	10.0
Starch	87.7	88.8	59.0
Protein	—	—	5.6
Aeration Chemicals	—	—	25.0
Ash	.3	.2	.4
	100.0	100.0	100.0

SWEDISH CROWN HARD RYE BREAD

By SIR W. ARBUTHNOT LANE, Bart., C.B., M.S., F.R.C.S.

RYE BREAD is a staple food in many European countries, but, as generally made by the peasantry, is dark, of close, soft texture, a little sour in flavour and from the æsthetic standpoint is not inviting. But, notwithstanding these drawbacks, it is nourishing, and contains all the essential elements of a whole cereal, including the vitamins, especially the anti-neuritic B, and it has sufficed for the needs of millions of people for centuries.

Rye bread has not been used in this country to any extent for dietary purposes, mainly on account of the characteristics already mentioned, but recently it has been finding a place on our tables in more attractive forms than the ordinary fermented bread common on the Continent.

Sweden has taken the lead in this direction, and the Swedish baking trade has discovered new methods of treating the rye, producing thin, crisp, flat loaf-cakes which form the staple food of the Swedish nation. Among the first rank of these breads is the Swedish Crown Bread made in the Kronan factory, the largest and most hygienic bakery of hard bread in Sweden, and holders of the royal warrant for the supply of this bread to the Royal House of Sweden. These loaf-cakes are now available in our English dietary and represent the actual hard rye bread as made in Sweden and eaten by the people and the Royal Household, and not merely varieties specially manufactured by modified processes for the English market. Swedish Crown Bread is much more concentrated than ordinary bread and breaks crisp both in the hand and teeth.

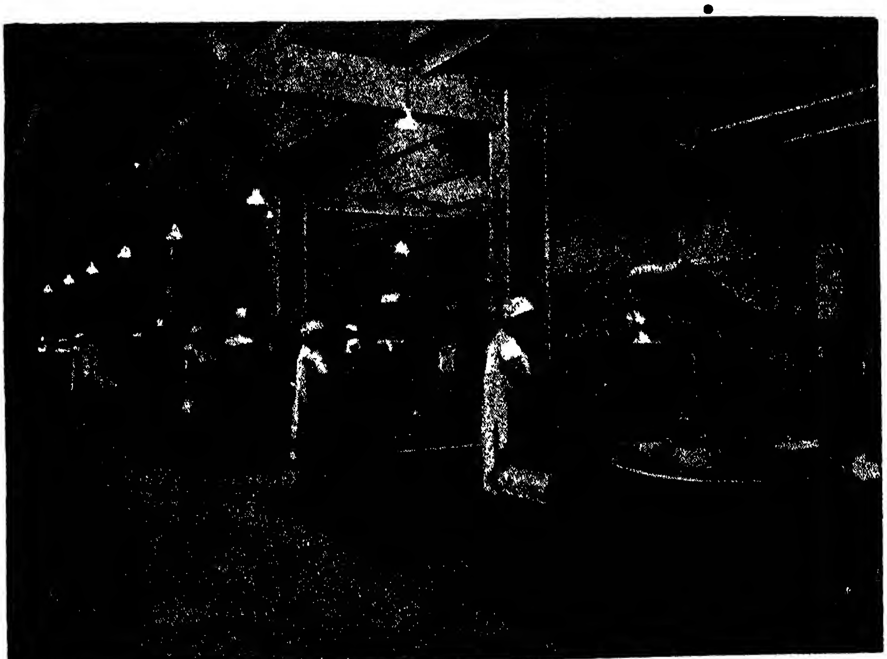
The physical condition of the crisp bread ensures thorough mastication, as the bolus for swallowing cannot be formed until thoroughly pulped by the teeth and mixed with the saliva, thus ensuring complete reduction and sufficient time for the digestive action of the saliva on the starch, the latter being converted into sugar. It gives the mouth structures something to do and thus helps to keep the teeth in a sound, healthy condition. Swedish Crown Bread also contains the full cereal complement of cellulose and fibre which gives the necessary roughage to secure healthy bowel action, and the vitamins A and B unimpaired in activity. For this reason it is an ideal form of bread for children, checking the general tendency in childhood to " bolt " soft foods.

The percentage composition of Swedish Crown Crisp Bread compared with white bread is as under :—

	Swedish Crown Crisp Bread	White Bread
Moisture	7.21	40.0
Protein	11.02	6.5
Carbohydrates ..	76.60	51.5
Fat	1.02	.7
Cellulose and Fibre ..	1.73	.3
Ash	2.42	1.0
	100.00	100.0
Vitamins A, B ..	Present	Trace
Lipoids	Present	Trace

The caloric value is as follows :—

1 oz. of Swedish Crown Bread yields 104 calories
1 oz. of white bread yields 69 „



Courtesy] [The Kronan Factory, Sweden

MAKING SWEDISH RYE BREAD

A view in the large Swedish factory near Stockholm showing the machinery for making the thin crisp " Crown " rye bread.

These figures show it to be much more nutritious and a better balanced food than white bread. Being made from the whole grain the lipoids—organically combined phosphates, essential to the nutrition of brain and nerves—are present in notable proportions. Swedish Crown Rye Bread will be found a very acceptable change to our ordinary white bread, and eaten with butter and cheese forms a well-balanced food giving a high percentage of flesh formers and a full vitamin content.

ST. VINCENT ARROWROOT

By JOHN CAMPBELL, Ph.D.

For generations genuine arrowroot has been highly esteemed as the most digestible of all the starches, and especially in sick-room dietary it is known to be a most valuable food in conjunction with milk in all gastro-intestinal troubles.

The name is derived from the Indian word "Ara-ruta," meaning "mealy root." The genuine arrowroot is the starch derived solely from the roots of the *Maranta Arundinacea*, a native of tropical America, but largely cultivated in the East and West Indies and other countries. Formerly Bermuda was the chief area of origin, but the manufacture of arrowroot in that island has practically ceased, and the industry is now centred in St. Vincent.

The roots and rhizomes of other allied plants yield starches which distantly resemble true arrowroot, and some confusion has arisen by the use of the word in relation to these products.

The trade term "British Arrowroot" is a misnomer, and is applied to the starch derived from the potato or from maize. Except that it is composed of the same food principle—starch—it has nothing in common with pure arrowroot. The term "arrowroot" should be restricted to the genuine product of the species Maranta, and if housewives ask for "St. Vincent Arrowroot" they will be sure to get the genuine article.

The manufacturing operations are directed to the objects of removing the starch from the rhizomes in as pure a condition as possible. But the system adopted is crude and laborious, and not adapted to modern economic conditions of production. There are indications, however, that improvements in this direction are being introduced, and with modern plant and machinery the cost of production should be greatly reduced, bringing the price of this pure and valuable carbohydrate nutrient down to a competitive point, placing it within the reach of the masses for all culinary purposes where starch forms the basis of the food, as in custards, starch jellies, blancmanges, or when used in conjunction with wheaten flour in the baking of cakes and pastries. Already there has been a great reduction in price.

Preparation.

The main operations, after the preliminary washings, paring and pulping, are directed to the removal of all fibrous matter and the bitter principles present in all starch-yielding roots, leaving the separated starch in as pure a condition as possible. These objects are accomplished by frequent dilutions with water, and straining through sieves and muslin. The turbid liquid is then passed to precipitating tanks, where the starch settles to the bottom. The supernatant fluid is drained off, and the residue washed until the effluent runs clear.

The arrowroot deposit is now dried in air in trays or copper pans protected by suitable covers from dust contamination, and finally finished off by gentle heat. The yield is from 15 to 20 per cent. of arrowroot.

The colour, upon which the commercial value depends, palatability and digestibility of arrowroot are governed entirely by the thoroughness of the washing and drying processes, which involve much time and labour. With suitable machinery these operations could be considerably shortened with less manual labour, effecting a great saving in the cost of production and improvement in quality.

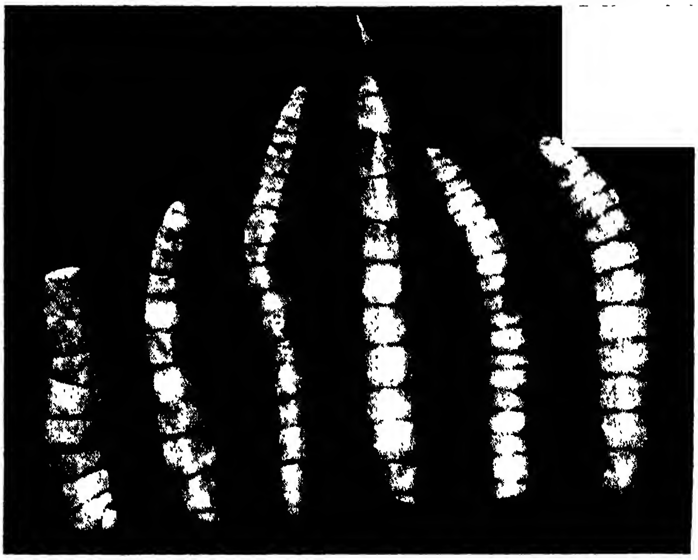
Arrowroot may be regarded as almost pure starch, fibrous constituents being practically absent.

Food Value.

The mean of several analyses by the writer gave the following results :—

ST. VINCENT ARROWROOT

Water .	14.82	
Protein	.72	
Fat .	—	Calories per ounce as bought, 98
Starch .	84.24	
Fibre .	.04	
Ash .	.18	Calories per ounce (dry) 166
	100.00	



ST. VINCENT ARROWROOT
A natural starch food which is completely absorbed in the process of digestion.

Exhaustive experiments show that arrowroot is completely absorbed in the alimentary canal, leaving no residue. By digestive processes it is converted into a simple form of sugar forming a source of liver sugar, which in turn feeds the muscles as required with carbohydrate material for energy.

Arrowroot starch grains are small and oval or pear shaped, averaging 0.014 mm. in size, gelatinise very easily and thoroughly, and less is required to form a jelly of a given strength than is the case with most other starches.

Arrowroot in the Sick Room. Arrowroot, as a basic carbohydrate food, is a great stand-by in all cases where fibre and cellulose are to be avoided, as in gastro-intestinal troubles and where it is important that little or no residue should remain in the intestine. With egg albumen it is most useful in diarrhœa and mucous enteritis. Gelatinised, it forms one of the most successful bases for the injection of opiates per rectum in cases of a dysenteric nature.

When added to milk and the mixture raised to the gelatinising point, it has a specific action in preventing coarse clotting of casein, rendering the milk, ordinarily too heavy for patients, invalids, old people and convalescents, easy of digestion, the curd being precipitated in a soft, flocculent form readily reduced by the digestive juices.

In the later stages of infant feeding it may be used successfully for the same purpose. In fevers, where a milk diet is indicated, arrowroot not only breaks the coarse curd, but supplies additional carbohydrate material, increasing the daily intake of calories, thus sparing the precious tissue protein. Being a carbohydrate food it should, where practicable, be used in conjunction with eggs and milk to supply the needed protein, fat and vitamins.

Arrowroot forms a smooth thickening agent for soups and sauces, and produces blanc-manges, boiled custards, creams, opaque jellies of a specially digestible and bland character. It forms a lightening addition to steamed puddings and home-baked bread and scones, and with egg and milk well-balanced digestible meals are obtained, providing all the elements needed for nutrition.

Arrowroot also forms an admirable basis for the opaque salts used in gastro-intestinal radiography.

The traditional reputation of arrowroot for sick-room dietary has probably overshadowed its use for ordinary culinary purposes, and its possibilities as part of our daily rations have been largely overlooked. But surely a starch, possessing so many admirable digestive and dietetic properties, should find a more permanent place on the kitchen shelf. It is possible that the old granular form of the imported arrowroot may have militated against its more extensive use in the kitchen,

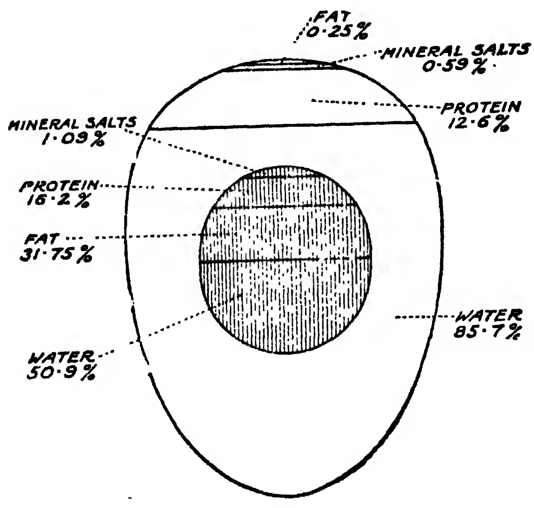
as fine forms of starch are the best for cooking purposes. This disadvantage is now overcome as pulverised genuine St. Vincent arrowroot is now available in the finest physical condition for the preparation of the numerous types of food in which starch forms a considerable proportion of the raw ingredients. Packed in cartons or tins, arrowroot custard substitute, egg and blanc-mange powders, would be a most welcome addition to our tables, and place within the reach of all this valuable energising food in handy and convenient forms.

EGGS

By Professor J. L. ROSEDALE, D.Sc., Professor of Bio-chemistry at the King Edward VII. College of Medicine, Singapore.

THE egg has a peculiarly important place among our foods. It is a concentrated food generally classed with the meat foods, but its dietetic composition is not altogether similar to ordinary flesh.

The egg is essentially a complete living organism while a joint of beef is only a portion—a very small portion—of an animal. From the egg may be developed, under suitable conditions, a living bird, developed much in the same way as a plant grown from a seed. The egg contains everything that is required to nourish a bird to the stage where it is able of itself to eat the normal rations of birds. Were the egg not complete in everything that is needed for avian nutrition, it would not be able to do this. Avian nutrition has at any rate one important difference from human nutrition. It is not necessary to supply the anti-scorbutic vitamin contained in the fresh, juicy fruits which is one of the important needs of man. Therefore we must not expect to find this vitamin in the egg, and scientific research has shown that this substance is, indeed, absent. The other materials which are essential to the diet of man are, as far as we know, also required by birds and are therefore found in the egg. Of course it does not necessarily follow that the actual proportions of the dietary essentials should be the same for man as for the bird, but at least we may say that, with the important exception already mentioned, the food essentials are all represented in the egg.



THE COMPOSITION OF AN EGG

Showing the average constituents of the white and of the yolk. The white contains no vitamins, but the yolk is a good source of A, B, and D.

It is a property of living material to contain much water in its composition. Fresh vegetab'es contain from 70-90 per cent. of water, the whole animal contains 80 per cent. or more of its weight as water, depending mainly upon the amount of fat that it possesses. Eggs are no exception, for they contain 70 per cent. Considering the dry weight of the egg, however, we find that about one-third of the solid food is composed of protein from which the perfect bird can be built. This gives us ground for confidence that these proteins will be of the utmost value in human nutrition. The fat-soluble vitamins and the water-soluble vitamin B are essential factors to the bird, and these substances are therefore found in the egg, which also contains a supply of mineral matter.

One of the main points to remember is that the fresh egg contains substances which we need in our daily diet. When the egg becomes stale and is attacked by bacteria, putrefaction begins and the nature of some of its contents becomes changed, perhaps adversely from the standpoint of nourishment. It is at least well known that such eggs are useless for hatching.

Eggs may be used in numbers of ways and for different purposes. As a meat substitute the common ways of preparing them are by boiling and poaching. When eggs are fried or made into omelettes the energy value is slightly increased on account of the addition of fat which is used in cooking. Experiments carried out in different parts of the world seem to agree that the soft boiling of an egg causes its maximum digestibility to be realised. Recent experiments have shown that eggs preserved by cold storage retain their supply of the fat-soluble vitamin for nine years, but that this substance deteriorates when eggs are preserved in water glass. There is, of course, no evidence that this latter method of preservation is in any way deleterious to the protein, and such eggs may certainly take their place in an ordinary mixed diet along with the protein foods. Eggs are invaluable in the preparation of cakes and puddings for raising and binding purposes, and their use is naturally preferable to that of baking powder.

Use of Eggs.

It should be pointed out that eggs work splendidly with wholemeal flour in cake making. Storage by immersion in water glass should therefore become more general. In the spring months twenty dozen eggs could easily be laid down for the winter and would be useful for many purposes. The cost of buying twenty dozen eggs and enough water glass for their preservation should not exceed twenty-five shillings if the eggs were bought direct from the producer, and, indeed, in many cases it will be found this is too high an estimate. Fresh, clean, infertile eggs only should be used for the purpose and all cracked, misshapen, and thin-shelled ones must be rejected. If these are bought direct from the producer, there is far more check upon quality and suitability of the produce. The little extra "richness" in cakes and puddings caused by the addition of an egg is within the reach of many, if they take the trouble to do their own preserving during the season when the eggs are plentiful and cheap.

PRIZE EGGS

While it must be borne in mind, therefore, that the fresh article is always superior, the value of the properly preserved egg is by no means to be ignored.

This country imports eggs to the value of approximately twenty million pounds a year, and it has to be noted that, with the exception of Irish eggs, imports are mainly from countries which do not belong to the British Empire. It is therefore desirable that the householder should use the home-produced article as much as possible, because not only are fresh eggs superior for all purposes (including preservation) but because increased demand will secure increased supply, and the saving to this country of the money now spent on importing eggs is large enough to be reflected in the annual budget.

In addition to their value as food, eggs may be made an exceedingly valuable asset to the country as a means of increasing the production of food within the shores. Throughout the kingdom, in city as well as in country districts, it is possible to produce new-laid eggs all the year round. Most of our large cities, such as London, Leeds, Sheffield, Newcastle, etc., have their poultry societies where the "backyarders" have their regular meetings and are taught to keep their birds under hygienic and profitable conditions. It is noteworthy that at one of the important shows recently, a bird bred and owned in Bethnal Green won a championship cup in competition with birds belonging to large breeders. Extension of the egg industry may therefore be confidently expected, and research into the physiological

and economic uses of eggs is much to be welcomed and encouraged.

BUTTER

By JOHN CAMPBELL, Ph.D.

BUTTER has been used in human dietary from very early years and holds the premier place among the fatty foods.

In England butter is defined by the law to be the fatty product of milk or cream or both, and no other fat is allowed to be sold under the designation butter. The manufacture of butter is nowadays a highly skilled art and science, and is usually controlled at all stages by chemical and bacteriological expert supervision.

The object is to separate the milk fats from the ripened cream in as pure a condition as possible. In general the cream is separated from the milk by centrifugal force, pasteurised to destroy undesirable microbes and sown with the pure culture of the proper acidifying organisms. Under the action of these organisms at suitable temperatures, the cream is rendered acid and ripens, flavour and aroma being concurrently developed.

After the churning process the butter is washed and, if required, salted, and is generally marketed in wrapped packets of fixed weights.

In this way the public secure a clean food and are protected against weight frauds.

The chief proximate principle present is fat, therefore butter is a fuel food, one ounce providing about 215 calories according to the percentage of water present.

Food Value.

The average composition of butter is as follows :—

	Per cent.
Moisture	9.00—14.00
Fat ..	80.00—85.00
Protein (Curd)	0.75— 1.25
Salts ..	0.30— 2.50

The percentage of mineral matter will depend on whether the sample is salted, and the quantity of salt added. The maximum amount of water allowed by law is 16 per cent.

Butter fat is a mixture of several neutral fats, chiefly olein, palmitin and stearin, but in addition it contains about 8 per cent. of volatile fatty acids, which confer many of the gustatory qualities which distinguish butter from all other fatty foods.

The following table gives the proportions of the various fatty acids in butter according to Hehner.

Non-Volatile (Insoluble) Fatty Acids		Volatile Acids	
Palmitic ..	38.50	Butyric	5.45
Oleic	32.50	Caproic	2.09
Myristic ..	8.89	Caprylic	.49
Lauric	2.57	Capric	.32
Stearic	2.83		

The melting point of butter fat is low (31° - 34°C) due to the high percentage of olein present. In this respect it resembles the fat of the human body.

Butter contains a notable content of the fat-soluble vitamins A and D, and is therefore a specially valuable food for the growing subject.

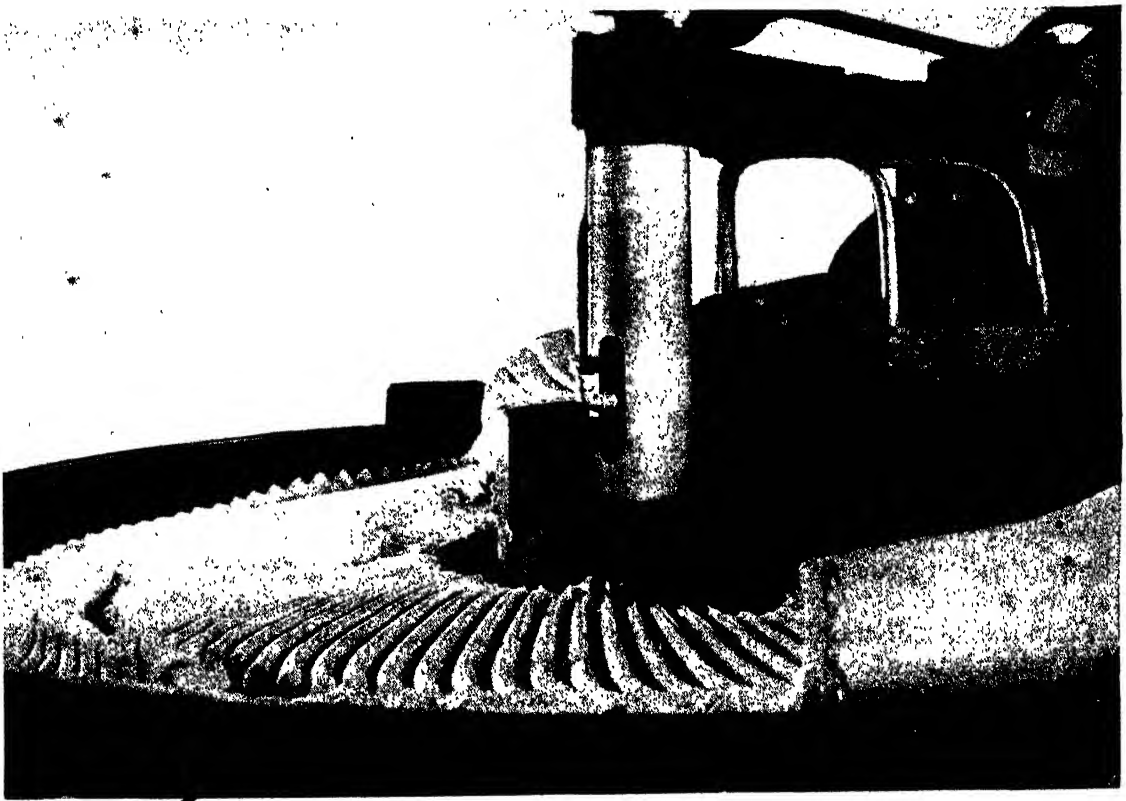
Fat-soluble A vitamin is associated with vitamin B (found in the non-fatty part of milk) in influencing the growth of tissues. When deficient in the diet, growth is retarded though the diet in all other directions may be perfectly balanced. Vitamin D, also present in cod-liver oil, is specially associated with the formation, growth and nutrition of bones and teeth, and when deficient in the diet rickets will develop.

Butter contains both these vitamins, so necessary in the diet of children, and therefore it should form an abundant portion of a child's daily dietary. For this reason, where means are restricted and the purchase of butter in a household is limited, it should be exclusively reserved for the children, and the margarine for the adults.

All authorities are agreed that milk fat is the most digestible of all fats. Even when comparatively large proportions are taken daily less than 0.5 per cent. remains unused.

Digestibility.

In cases of fat intoleration, where there is imperfect oxidation resulting in acidosis, butter is still well tolerated. In phthisis, diabetes and many forms of dyspepsia, butter



[Sport & General

BUTTER MAKING IN A MODERN DAIRY

A huge butter churn at work—a striking example of the use of modern machinery in preparing food.

has been found to be the most suitable source of the daily fat ration.

Speaking of the assimilation of butter Dr. Robert Hutchison* says :—

"The absorption of butter in the intestine is very complete, less than .5 per cent. being wasted.

"This is a more favourable result than would be obtained with any other form of fat, and should teach us that it may be well to give butter a fair trial before having recourse to cod-liver oil or other medicinal fatty preparations."

In human digestion, butter fats are acted on by gastric and pancreatic lipase (ferments), and partly split up into their glycerine and fatty acid constituents. These are absorbed in the form of soaps and reconstituted to form human fat. Part of the fat, however, is emulsified and is absorbed directly as such by the intestinal villi.

* "Food and the Principles of Dietetics."

Butter and Margarine. Butter differs from most other fatty foods in the higher percentage of volatile fatty acids present. These give the characteristic flavour and aroma to pure butter.

Other animal fats do not contain these volatile acids in such abundance, and therefore lack aroma and flavour.

The butter fats themselves are also biochemically somewhat different to ordinary animal fats and vegetable oils, inasmuch as they are more easily emulsified and assimilated and are finally more easily completely oxidised.

Margarine is the most popular substitute for butter, and as manufactured under modern conditions is a pure and wholesome fatty food giving a caloric value equal to butter.

The bulk of margarine is manufactured from vegetable oils and these brands do not contain vitamins.

Other varieties contain varying quantities of animal fat (olein) and the vitamin content is then in strict ratio to the proportion of olein so included.

Recently, however, it is interesting to note that certain margarines have been placed on the market to which a cod-liver oil vitamin D concentrate has been added, bringing their vitamin D value up to equal that of butter. In this case the margarine is protective against the onset of rickets equally with pure butter.

Butter has the advantage over ordinary margarine and vegetable oils in flavour, aroma, digestibility and vitamin content, but on the other hand from the caloric and economic standpoint margarine is much cheaper, yielding weight for weight equal calories.

From the dietetic standpoint butter is our most valuable fatty food, and should be used in the fresh condition where the means allow in all sauces, puddings, cakes and dietary adjuncts in preference to vegetable oils, lard or margarine. Allowing from 1 to 1½ ounces of fat derived from other foods, our daily dietary would require another 1½ to 2 ounces of butter as a separate ration.

The custom of eating butter spread on bread or biscuits is based on sound physiological principles, as the mastication with starchy material separates the fatty mass into minute particles facilitating the action of the digestive ferments—the lipases, which prepare the fats for assimilation and reconstitution by splitting them up into their constituent factors—glycerine and the fatty acids.

THE NUTRITIVE VALUE OF MARGARINE

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C., Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

MARGARINE is the term applied to butter substitutes made by churning animal or vegetable fats, other than butter fat, with milk, so as to produce a butter-like emulsion.

Chemical analysis gives the following proximate principles for British margarine :

	Per. cent.
Water ..	13.0
Protein ..	0.2
Fat ..	84.8
Salts ..	2.0
Carbohydrate	
	100.0

According to Atwater the energy values of butter, margarine and lard compare as follows :—

lb. butter yields	3605	calories
lb. margarine „	3525	„
lb. lard „	4220	„

Thus, in providing energy to the body, margarine is equal to butter.

Legal standards in this country enact that margarine should not contain more than 10 per cent. butter, nor 16 per cent. water.

Margarine can be divided into two broad classes, viz.: vegetable margarine and animal margarine. Vegetable margarines prepared from cocoanut oil, cotton seed oil, maize oil or peanut oil contain little, if any, vitamin A. The remaining vitamins are, of course, absent. Margarine in the manufacture of which lard enters, is also usually devoid of this vitamin. On the other hand, animal margarine prepared from olein—the oily liquid expressed from melted beef fat—contains an appreciable amount of vitamin A, though not nearly so much as dairy butter. It should be remembered that the value of the margarine is in proportion to the quality and percentage of animal fat present. Animal margarine prepared from olein, i.e., oleomargarine, is a superior product to the purely vegetable margarine. Margarine manufactured from hardened oils usually contains no vitamin A. The vitamin content of nut-butters is variable. These results are summarised in the following table:—

	Vitamins A	B	C
Margarine (vegetable)	trace	o	o
Margarine (lard)	trace	o	o
Margarine (animal)	+	o	o
Oleomargarine ..	+	o	o
Nut butter ..	variable		

Manufactured under proper conditions, margarine is a wholesome article of food.

[Photopress

A VIEW OF AN ENGLISH APIARY

Honey is a valuable form of natural sugar much appreciated by children.

Comparison with butter shows it to contain nearly the same percentage of fat, the latter being also well absorbed. Turning to the problem of school dietetics, margarine should not be relied upon to supply the fat-soluble vitamins essential to health, which are best obtained by consuming milk, butter, eggs and green vegetables. Margarine is of practical use as a cheap supplier of energy.

HONEY

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C., Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

HONEY consists chiefly of a mixture of sugars gathered from flowers by the bee and stored in combs as a food reserve for its own use in winter. In prehistoric times honey was probably the only sweetening agent known to early man, but with the large-scale production of cane-sugar and glucose at low cost it has become relatively a luxury. Honey is probably the only common food substance which contains more fructose (lævulose) than glucose (dextrose). Adulterations with cane sugar and glucose syrups, which in the past appear to have been considerable, are usually readily detected by knowledge of these facts. The production of honey still constitutes an important industry in some European countries. In the Ukraine, for example, it is said the peasants make more money by their honey than by their corn, while in certain parts of Spain the number of hives is enormous.

Honey is described by Tibbles as a "viscid, transparent, syrupy liquid or soft, opaque mass, becoming more opaque, crystalline and of semi-solid consistency." In colour it varies from white or pale-yellow to yellow-brown. The colour, flavour and odour of honey are due to the presence of foreign substances found in the nectars of different flowers. The presence of such substances gives rise to the many different varieties of honey, some of which, like those of Mount Ida and Narbonne, are highly prized.

On account of its delicate flavour, honey in the comb is usually preferred to extracted honey. Honey is demulcent and laxative.

Because of its high content of energy-forming sugars (70-80 per cent.), honey has a

high caloric value. The remaining constituents include small quantities of alcohol, formic acid, pollen and aromatic principles. The following is a typical analysis of English honey :—

	Per cent.
Water	7.08
Fructose	36.90
Glucose	38.12
Fat	trace
Ash	0.15

Traces of calcium, magnesium, iron, phosphorus and potassium are found in the ash of honey.

There appears to be some difference of opinion as to the vitamin content of honey. According to Dutcher, American basswood and white clover honey has slight antineuritic properties, which he regarded as being derived possibly from the pollen of flowering plants. Accordingly, the Medical Research Council's Report (1924) accords a single plus for the vitamin B content of honey. Faber, in 1920, working with American white sage honey, found vitamin C to be absent. In 1921, Hawk, Smith and Bergheim, also using American white sage honey, confirmed this result, but found a moderate amount of vitamin A present in honey from the comb. They also detected minimal amounts only of vitamins A and B in strained honey. Scheunert and his co-workers in Germany, however, concluded from work on three different samples, that honey was devoid of vitamins A, B and C. In Ragnar Berg's latest table of vitamin values (1927), the vitamin content of honey is also given as nil.

From these experimental findings it would appear that although honey is generally a poor source of vitamins, it may contain small amounts of vitamin B, and possibly also of vitamin A. However, with the many varieties of honey on the market, a corresponding variation in its different constituents must be expected.

PASTORAL DIET AND HEALTH

By Lt.-Col. H. HALLILAY, M.B., M.R.C.S., L.R.C.P., Civil Surgeon, Rawal Pindi.

Of late years the question has often been raised and debated as to whether it is possible for a person to keep in good bodily health and to perform work upon a diet of wholemeal bread, fresh fruits and vegetables, supplemented with cheese and other milk products. Facts elicited from feeding experiments upon living animals have been adduced by various observers, and have no doubt contributed valuably to our knowledge, but such information, useful as it is, sinks into insignificance when compared with the results at our disposal from one most momentous and gigantic feeding experiment, not upon a few score of guinea pigs, but upon some 22 millions of people, the population of the Panjab, an experiment which has been in operation for a period of probably over 6000 years.

Panjab Experiment.

The Panjab, the Land of the Five Rivers, the Martial Province, supplies an unending stream of recruits to the Indian Army ; her sons have spread all along the Chinese littoral, where they are to be found as guards and doorkeepers wherever there are buildings to be protected or positions of trust to be filled. Almost the whole of the millions of people who are included in this population are occupied in agricultural or pastoral pursuits. Large towns are few and industrialism is in a primitive state. The bulk of the population are settled on the land and the land supplies almost the whole of their simple wants. Probably no people are less dependent upon the outer world for the necessities of life, and few people are more completely self-supporting than are the agriculturalists of the Panjab.

Contrary to the tradition established in the popular mind that all Indians are rice-eaters, the Panjabi is a wheat-eater, and seldom eats rice except in certain hill and submontane tracts which are favourable to the growth of this cereal. The unrelenting pressure of the laws of caste has kept this diet unaltered through all the centuries which have elapsed since the first Aryans

poured through the barren passes of the Himalayas and invaded the land, and though the dietaries of most nations have been profoundly affected by economic conditions, the food of the Panjabi cultivator remains as it was.

Diet of the Mass.

The staple of their diet is wheaten wholemeal bread. Meat if they eat it, even in races which are professedly meat-eating as the Sikhs, is eaten in great moderation, perhaps a quarter to half a pound once a fortnight. The upper classes, however, even when orthodox, indulge in it more freely. Briefly, the diet for the mass of the people consists of cakes of unleavened wholemeal bread, supplemented with dal—a pulse which is boiled until it is reduced to a sort of thin paste. For the dal are often substituted vegetables cooked in butter (ghee) or made into a sort of curry with condiments. It is to be remembered that condiments in abundance are produced in the province. Ginger, coriander, red pepper (chillies), mustard, garlic, onion, mint, turmeric and a host of others are produced in plenty. Indian corn is eaten in season both in the cob, which may be either roasted or boiled, or in the form of unleavened cakes made from the meal of the ground seeds. Vegetables of all sorts both raw and cooked are eaten, as well as an abundance of raw sugar-cane. The long cylinders of the raw cane are peeled, cut into short lengths by a small machine, and sold at every street corner and railway station in the province. The stem is chewed, the saccharine sap swallowed and the excess of woody fibre spat out. Fruit is also plentiful and within the reach of all in the country districts.

Owing to the fact that in this country the land is under cultivation practically all the year round, there is an unfailing supply of fruits and vegetables. As soon as the fierce summer is at an end the curious second spring is at hand, in which all the Western flowers and vegetables mature. In this season, from October to April, flourish peas, beans, beetroot, spinach, cabbage, cauliflower, in short, all the vegetables which grow in the British Isles in summer. When these decline the soil is cleared for the indigenous vegetables and fruits such as melon, cucumber, pumpkins of various sorts, gourd, water melon, mulberry, egg-fruit, ladies' fingers, and many other varieties too numerous to mention. The fields of the Zemindar, like those of his Egyptian contemporary, are practically always under cultivation, and it is seldom that the cultivator is not chewing some form of raw vegetable, such, for example, as the indigenous radish, a root about a foot long and nearly as thick as a man's arm. The predilection of the Panjabi for raw fruit and vegetables has been emphasised to show that he gets a sufficient load of cellulose or "roughage" and that he is not handicapped in his efforts to get rid of the waste products of his digestive processes by a lack of load for the muscular tissues of the intestines to work upon.

Milk Foods.

We now come to the last and not least important of the list of articles of diet, viz.: the milk foods. These bulk very importantly in the diet of the Panjabi peasant. He employs cattle extensively in his agricultural operations both for plough and for transport. The patient gigantic water-buffalos which drag the creaking wheels of his huge prehistoric ox-wagons through the mire or dust of his unmade country roads to market, supply him with a milk rich in cream, in lime salts and in sugar. In addition he keeps cows sacred to the Hindu. These animals assure him a supply of ghee (clarified butter), of milk, and of curds and butter milk. Fortunate Zemindar! Little wonder that his wife can suckle her children for as long as she desires, that the teeth of the Panjabi are exempt from the ravages of caries, and that rickets are practically unknown in the Panjab villages. Can any people show a diet better balanced, richer in the accessory food factors? Does the diet of any people conform more closely to what has been laid down by experts as a perfect diet? In connection with the present ideas about the "D" factor, it is remarkable that the Panjabis 20 years ago were ascribing the

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FARMING IN THE PANJAB—I.
Panjabi farmers threshing paddy—a primitive method of separating their rice grain.

decline in physique of some of the clerkly classes to a deficiency in the supply of milk foods. " In the days of our fathers milk was cheap and abundant, and they grew up strong and sturdy with good bone, but we their sons, who were deprived of milk in our youth, are not as they were."

The manner in which the staple of this diet is prepared will now be considered.

Bread and Flour.

The flour is essentially wholemeal. It is prepared by grinding the whole grain in stone querns which are driven by hand, by water or by oxen or cattle. Many households grind their own corn. The mill is a primitive but efficient affair consisting of two stone disks of which the upper is rotated upon the lower by means of a short wooden handle set vertically into the periphery of the upper stone nearer to the free edge than to the centre. The upper stone is balanced on an iron pin which fits into a hole in its centre and which is seated firmly into the lower stone. The grains of wheat are allowed to fall between the two disks by means of two small slits on each side of the central pin, and as the flour gradually becomes finer and finer it is sped by the centrifugal action of the rapidly revolving disc towards the edge of the lower stone from which it falls down into the crater in which the whole apparatus is fixed. The upper stone is heavy and weighs about 40 or 50 lbs. The flour thus obtained is then subjected to a primitive process of sieving through a coarse sieve of a one-sixteenth inch mesh. This flour is now known as " ata " and contains the whole of the wheat grain with the exception of some of the coarser husk. It contains the whole of the germ, the bran, and the endosperm. The seed of the maize or Indian corn is also treated in the same manner if it is desired to obtain the flour.

The ata is made into a dough with water, kneaded and the dough divided into pieces of appropriate size which are rapidly patted out between the palms of the hands until they assume the shape and dimensions of our English pancakes. These are thrown on to a sheet of heated iron known as a tawa under which a fire is burning. As one side becomes scorched the cook deftly seizes the cake with

a pair of primitive looking tongs and rapidly reverses it so that the upper surface is cooked in its turn. The chappaty, as it is now called, is eaten hot or as hot as possible, with the semi-liquid yellow dal resembling thick pea soup or thin pease pudding. Curried vegetables may be eaten with the chappatties in place of the dal. These vegetables are cooked in condiments and ghee. This dal chappaty or dal roti (bread) is the basis of the food of the millions of the men, women, and children of the Panjab, from the time they leave their mothers' breasts until the day of their death. At one time millet was used by the poorer people instead of wheat, but now with the rise of prosperity and of the standards of living among the labouring class in the Panjab, there are few indeed who do not eat wheaten bread.

Rice is eaten in the hill tracts and elsewhere, in the province where local conditions are favourable to the growth of this cereal, but the rice so grown is principally for local consumption and is not polished. When the rice crop is cut it is husked by pounding it in heavy mortars. The task of polishing it would be far beyond the primitive appliances of the simple hill people who grow it on their terraced farms. The rice when husked is boiled and eaten with curried dal or vegetables. Like most people who have become habituated to rice, they seem to find it essential even when they can get food superior to it in the production of stamina and energy.

Milk.

Few people on earth when arrived at man's or woman's estate drink the quantity of milk which is consumed by the Panjabi peasant. Warmed and sweetened with sugar it is drunk by the gallon by the ploughman. Visitors to a Sikh village are frequently compelled to swallow quarts of

FARMING IN THE PANJAB—II. [E.N.A.

Ploughing with oxen near Lahore. Digestive diseases are almost unknown in this part of India, where the natives live an outdoor life and eat a healthy, natural diet.

this delicacy as a mark of the respect and esteem in which they are held by the inhabitants. It is also taken in the form of curds and buttermilk, a variety of milk food which, by the way, to judge by the nursery rhymes, must have been more highly esteemed by our ancestors than ourselves. It is prepared as follows: the whole milk is heated overnight and when cooled a small portion of curd is added to it; the milk curdles and the buttermilk is churned out and may be drunk thus.

Butter.

Properly speaking, butter as such is not eaten in the Panjab by the peasantry. The fat of milk is treated as follows: the whole milk is warmed, then a portion of curd is added to it when sufficiently cool, curdling takes place and the buttermilk separates. When this has taken place, the whole mixture of curds and buttermilk is churned up by means of a wooden paddle rotated by hand somewhat in the fashion of the carpenter's bit and brace. The butter is formed and removed from the mass of curds and buttermilk. This butter is melted down and clarified by boiling. Thus treated it is stored and will last indefinitely, whereas butter in a hot climate deteriorates with startling rapidity. It may be added in passing that it is becoming increasingly difficult to obtain pure ghee in the towns. It is so adulterated with vegetable oils that it is extremely difficult to detect any of the original butter fats in the "product." This of course does not apply to the ghee prepared by the Zemindar for his own use in his own home. Whole milk, solid, prepared by boiling until the whole of the water has left it and it is of the consistency of putty, known as khowa, is also eaten. It forms an important ingredient in the preparation of certain sweetmeats. It is regarded as a highly strengthening food and very nutritious. The liquid residue of the butter-making is known as lassi (buttermilk) and is drunk in large quantities in the mornings. It is considered a cooling and wholesome drink.

Ghee.

The ghee is also much used as a frying fat in cooking, and as an ingredient in many dishes. It adds greatly to the richness of such dishes. There are many vernacular proverbs to the effect that those who eat cakes fried in ghee should work hard, or only those who toil laboriously should eat such rich food. Unhappily the reverse only too often takes place in real life; the toiler having to be content with the simple fare while the wealthy indulge freely in rich foods to the detriment of their health.

Fruit and Vegetables.

Owing to the existence of winter crops as already described, fresh fruits and vegetables are available all the year round in the Panjab—mulberries, plums, medlars, grapes, bananas, mangoes, figs, dates. It is said that when Alexander the Great came to India and invaded the Panjab some 2200 years ago, the soldiers' ration in an army coming from Mesopotamia consisted of dates, so that wherever the army halted, there the soldiers spat the stones of the ration about the camp. In the fulness of time a grove of date palms sprang up where the army had halted. This is said to be the manner in which the dates entered the Panjab. Apples, pears, peaches, apricots, plums, come down from the hills in abundance, while in the hot season there are melons, water melons, pineapples. Oranges are to be had in great abundance and in many varieties, limes sweet and otherwise, lemons. Mulberries are to be found in any road and field in the province in the early part of the hot weather. Almost every variety of vegetable is grown in the Panjab, including all those known to the West and a great number of hot weather vegetables which are unknown to it. There is a radish which is as thick as a man's arm and which is eaten raw, as are turnips and carrots and onions. Nuts of all kinds are to be had; almonds form an important part of the diet of the Panjabi wrestler when in training for a fight, and the wrestlers of the Panjab are world renowned.

Influence on Diseases.

The following diseases are rare among the inhabitants of the Panjab, especially in the agricultural classes; appendicitis, diseases of the gall bladder, gastric and duodenal ulcers, intestinal

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NATIVE WRESTLERS IN INDIA

Showing the supple bodies and fine physical condition possible with a diet of natural foods.

stasis, and finally all forms of cancer, especially those connected with the alimentary tract. The freedom of the Panjabi peasant from caries of the teeth and rickets has already been commented on. His freedom from such diseases as appendicitis and gastric and duodenal ulcers which provide an overwhelming proportion of the "Acute Abdomens" which are admitted to the charitable institutions and hospitals in the United Kingdom is even more striking. It would be possible for a surgeon to spend a lifetime among these people without meeting a case of these diseases or of the surgical emergencies which they engender.

The undoubted rarity of all forms of cancer has been explained by the entirely unwarranted assumption that the Panjabi does not live to the cancer age. In view of the fact that the statistical returns of the Panjab lend a sort of specious support to this statement it is as well to explain that the average Panjabi peasant has but the remotest idea of his age and almost invariably understates it by some 10 or 15 years. It is probably very difficult for those who are literate, who are surrounded by time-tables and almanacs, whose newspaper is delivered to them daily, to put themselves in the place of those illiterate peasants whose only almanac is the slowly changing face of the fields which they cultivate. With such a people a man's age is not the clear cut and insistent fact that it is with us, and as the slow rotations of the seasons accumulate so the conception of age becomes dim and indefinite. The vagueness of the illiterate villager with regard to his own age has undoubtedly given rise to the idea that there is a paucity of persons of the cancer age in the Panjab.

Three diseases are prevalent enough to affect the bills of mortality in this province. They are malaria, plague and cholera. Of these the most prevalent and far-reaching is malaria in its various forms. Apart from the actual loss of life which it causes it is responsible for a great deal of chronic ill-health and disability, and in lowering the

vitality of its victims it renders them liable to the inroads of other diseases. In spite of these ever-present disadvantages, disadvantages from which the bulk of the inhabitants of these islands are free, there is the striking fact that the Panjabi shows this happy immunity from the diseases mentioned. In all other respects he is living under conditions infinitely inferior to those under which the average Britisher exists. As regards sanitation, water supply, housing, lighting, heating, clothing, there is no comparison; the Britisher has the best of it in every way. Hence it brings home to us the supreme importance of diet in our lives for it is only in this respect that the Panjabi has any advantage over the Britisher.

If the reader has followed the description which I have given of the Panjabi diet, he will realise that it is a diet essentially rich in vitamins.

The "A" factor is abundant in the milk, butter, cream and green vegetables which are the produce of his fields. The "B" vitamin is found in quantities in the wholemeal flour and the pulses which are the staple of his daily fare, while thanks to the varied seasons and frequent crops he never wants for fresh fruit and vegetables, the great reservoir of the "C" factor. The "D" vitamin is provided in the articles of diet which contain the "A" factors.

This abundant supply of the accessory food factors seems to guarantee a certain and copious supply of milk to the nursing mother. The breast of the Panjabi mother is, in nearly all the cases that I have seen, splendidly developed, and it is rare indeed for a child to be brought up on the bottle.

In a nation of breast-fed children we shall not be surprised to find a notable absence of rickets and the deformities which it engenders. I believe that the practice of breast feeding is responsible also for the freedom of all classes from dental caries, though this no doubt is assisted by the dietetic habits of the people in eating an abundance of hard food. I have, however, seen magnificent teeth in the mouth of a rice-eater who assured me that he had never eaten any hard food in the whole of his life, so that it is perhaps permissible to suspect that there are other factors at work beside those of hard work and hard food.

The fertility of this people is amazing, a birth-rate of 42 per 1000 is a well sustained figure.

With regard to the teeth I forgot to remark when discussing the subject that it was by no means uncommon to find 32 perfect teeth in the jaws of octogenarian men or women. Upon the freedom of the Panjabi peasant from abdominal diseases and emergencies I have already commented.

[W. F. Taylor

THE "MILKMEN" OF THE PANJAB
Carrying milk to the market on the outskirts of Simla.

Courtesy] [*Cadbury Bros., Ltd.*

COCOA BREAKING IN A TRINIDAD PLANTATION.

BEVERAGES

By JOHN CAMPBELL, Ph.D.

WATER

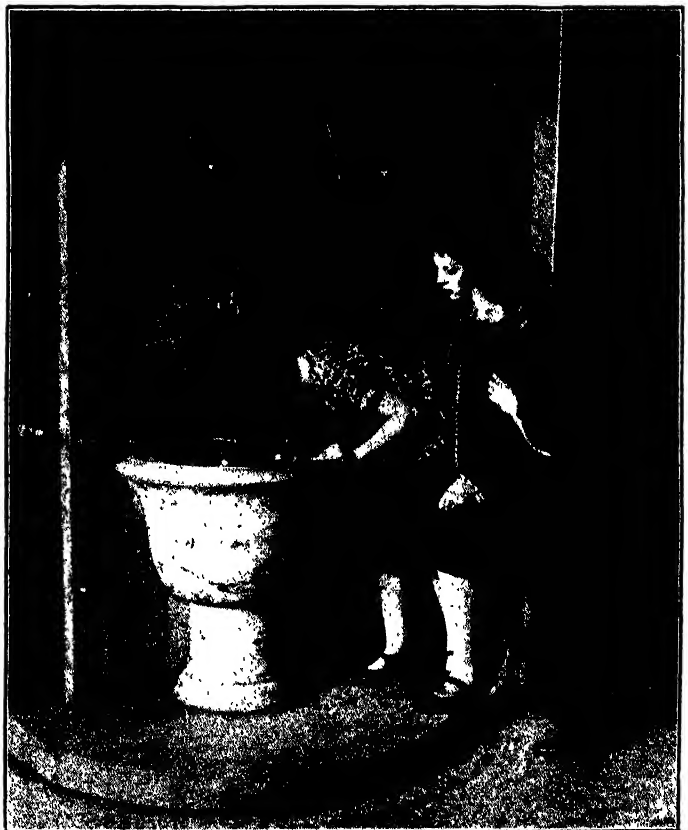
THE natural beverage of man is fresh water, and in the earliest ages of human development formed the sole separate source of fluid food. As time went on and the human race progressed into more civilised conditions, for various reasons—chiefly gustatory and physiological—man developed the custom of modifying the pure water by additions, often combined with extractives from plants or fermentive processes, producing drinks with distinct and pleasing flavours, and sometimes containing principles like alkaloids and alcohol, conferring specific physiological properties to the basic water.

The body loses on an average about 5 pints of water daily in the excretions, expired air, and perspiration, and this quantity per day is therefore required to maintain equilibrium. The quantity of water lost, however, varies within wide limits, depending chiefly on the activity of the sweat glands, as determined by external conditions of temperature and internal production of heat. About half the quantity of the water needed is supplied by ordinary diet, leaving from two to three pints to be taken separately as liquid food.

A good drinking water is characterised by the absence of pronounced colour and odour, giving an agreeable freshening effect to the palate, and should contain a fair proportion of dissolved air. Distilled or boiled water, having been deprived of its dissolved gases, is flat and insipid to the taste and lacks refreshing properties. Most drinking water contains mineral matter in solution, mainly salts of lime and magnesia, and so long as the quantity is not excessive their presence is not detrimental to health.

The inclusion of sufficient water as a separate food in the daily diet is of the utmost importance to the maintenance of good health, especially in aiding bowel evacuation and the excretion of waste matter in the urine and sweat. Water is not absorbed to any extent in the stomach. When ingested it is quickly passed on into the bowel.

No hard and fast rules can be laid down as to the best times to take water. The demands of the body for water, as manifested in the physiological sensation we call thirst, should be always adequately satisfied, and generally the amount taken should not be excessive at meals. A pint should be taken soon after rising, flavoured, if desired, with fresh lemon, orange or other fruit juice.



[British-Continental

A MODERN DRINKING FOUNTAIN

Drinking clean, fresh water—the natural beverage of man—from one of the new fountains in which the jet rises to the mouth.

The public sources of water supply in our towns are beyond suspicion, being efficiently filtered and purified, and under the control of public analysts. In small villages and isolated country houses, however, the source of drinking water is often from streams and wells, liable to contamination from surface water containing excretal matter, and care should be exercised to ascertain the purity of supply.

Spring and upland surface water from rills is usually safe, and the same is true of deep or artesian well supply. In the case of shallow wells the danger of contamination is greater. If the purity of the water is not certain, samples should be submitted from time to time to the County or Borough Public Analyst for examination and report. In all doubtful cases the water should be boiled or passed through an efficient filter before being used for drinking purposes. Boiled water may be re-aerated by pouring many times from one jug to another in a thin stream from a convenient height, or by the use of a gazogene. Rain water if used for drinking purposes should be filtered through muslin, boiled and re-aerated.

The consumption of MINERAL AND AERATED WATERS is enormous and on the increase. The basic water is artificially charged with carbon dioxide (CO_2) and small quantities of certain alkaline salts are added. These sparkling waters are very palatable additions to fruit juices, spirits, wine cups and milk, and have slight tonic effects and serve to neutralise excessive acidity. The chief alkalies used are the carbonates and bicarbonates of soda, potash and lithia. The proportion of salts added ranges from 5 to 10 grains per pint, and taken in moderation they are harmless.

SPA WATERS are of a special nature and have distinct beneficial medicinal properties and action on various diseases. They are not beverages in the strict sense and should only be taken under medical advice.

AROMATIC BEVERAGES

These include a large variety of flavours, sold under the designation of Ginger Ale, Lemonade, Orangeade, Kola and numerous proprietary names. Most of them are ærated and in the main are harmless. The most popular is "dry ginger," and it forms a most pleasant slightly stimulating beverage without alcohol. The food value is practically nil.

GINGER BEER stands in a different category as it is a fermented beverage and therefore contains small quantities of alcohol. It is flavoured with ginger, though some brands are unfermented and artificially compounded. In the same class are the numerous "hop ales," fermented and flavoured with hops, also containing a small percentage of alcohol. In moderation these beverages are harmless and exert the characteristic tonic or stimulating effects of the particular ingredient used as the principal flavour.

FRUIT JUICES

Diluted expressed fresh fruit juices are among the most pleasant and healthful beverages, giving vitamin C and the natural fruit acids and mineral salts. With plain or aerated mineral water they are delicious thirst quenchers. Failing juice from the fresh fruit, the surplus liquor from stewed or canned fruit may be used. The favourite fresh fruits used for this purpose are the lemon, orange and grape.

Fruit beverages may also be prepared from the many bottled squashes now on the market. These are prepared from the fresh fruit and form excellent substitutes when fresh fruit is not available. The vitamin content in reputable brands is intact. The bottled lemonade and orangeade sold in bottles have little in common with the fresh preparations, being usually compounded from syrups, tinctures and essences. Lime juice is the concentrate prepared from fresh limes and forms a pleasant change to lemon or orange juice, though not so valuable as a source of vitamin C.

Many of the cordials and compounded aromatic beverages contain ethers, and are sweetened with saccharin instead of sugar to obviate fermentive action. There can be no question that fruit beverages are best

Courtesy] [" Good Housekeeping"

INGREDIENTS FOR A HEALTHY " THIRST QUENCHER "

The juice of fresh fruit such as lemons, mixed with plain or aerated water, provides vitamins and mineral salts as well as necessary fluid for the body.

prepared from either fresh fruit or reliable concentrates or squashes, and are preferable to the compounded artificially coloured drinks in the preparation of which chemically separated fruit acids, ethereal essences and saccharin are used.

In many cordials and drinks the natural fruit ethereal flavouring constituents are absent, their place being taken by artificial bases simulating in flavour the genuine natural ethers and aldehydes. These beverages are best left alone. While the quantities of these ingredients present are so minute as to be harmless at reasonable intervals of ingestion, long continued regular use may exercise pernicious effects on the system.

The iced " phosphate " drinks, fruit flavoured, dispensed from the American soda fountains, are pleasant thirst quenchers and in moderation are harmless. The addition of ice cream to fruit and other drinks not only cools the beverage but enhances the flavour, and adds a small proportion of nutriment.

ALCOHOLIC BEVERAGES

The most important constituent in alcoholic beverages is ethyl alcohol, and their dietetic importance and physiological effects depend entirely on the action of that narcotic. Alcohol is produced from sugar by the action of yeast which splits it up into the primary products, ethyl alcohol (C_2H_5 OH) and carbon dioxide (CO_2), with small quantities of secondary products, including higher alcohols, ethers, aldehydes, furfural and organic acids. The principal alcoholic beverages are :—

(1) Malt liquors—ale and stout.

(2) Wines (*a*) natural (*b*) fortified—white and red.

(3) Spirits—gin, whisky, brandy.

(4) Rum.

(5) Cider.

Malt Liquors. Pure beer is produced by yeast fermentation from germinated barley (malt) worts and hops. The action is not carried to the extreme stage, so that the fermented wort still contains unaltered sugar, dextrin and other soluble constituents of the malt. After classifying and conditioning, the beer is delivered in barrels to the retailer to be sold as draught beer—bitter, burton, old ale.

The worts for ales are produced from ordinary malt, giving the well-known ranges of brown tints, while for stout the malt undergoes a preliminary roasting process, in which a small proportion of caramel, a black substance, is produced from the malt sugar, giving the characteristic colour. Sometimes the same effect is imparted by the addition of caramel to the liquor.

Bottled Beers. A very large proportion of malt liquor is sold in bottle, a secondary fermentation taking place in the bottle. This results in an increase of the alcohol content, and the production of gas (CO_2) which naturally aerates the liquor, the yeast at the end of the action falling to the bottom as a sediment. This cloudy portion is usually rejected in decanting because it spoils the clarity of the liquor, yet from the dietetic standpoint it is quite wholesome, yielding vitamin B. In some cases the beer is clarified before bottling and then artificially aerated. Bottled ale and stout are sparkling and on this account are preferred by many people to draught beers although they cost more.

Beers vary very considerably in specific gravity, alcohol content and total solids. Generally, the alcohol varies from 3 to 6 per cent., with an average of about 4. The total organic solids, including sugar and dextrin, amount to from 4 to 7.5 per cent., with a mean of about 5. The ash averages 0.25 per cent., and the acidity (as lactic acid) about 0.15 per cent.

Apart from alcohol, malt liquors contain varying proportions of energy foods, chiefly in the form of carbohydrates and also properties derived from hops. The quantity of protein present is negligible. The beers vary widely in their alcohol and carbohydrate content. The light lagers and pale ales contain the least alcohol and extractive matter, while the old ales, barley wines and heavy gravity stouts contain the most.

Pure beer is manufactured from malt and hops, but often the brewer seeks a cheaper source of sugar than malt and uses proportions of raw grain—maize, rice, etc., cane sugar, invert sugar and glucose.

Wines. Wines are prepared from the fermented juices of grapes, by a yeast which is proper to each kind of fruit and found on the skins, and which differs from the strains that act in malt liquor. The primary action is fundamentally the same as in the case of beer, but the secondary products differ considerably, a higher percentage of ethers being produced. In the preparation of red wine the skins are left in the fermenting vat and the alcohol dissolves out certain pigments that are turned red or purple by the action of the fruit acids. Wine musts also contain varying quantities of tannic acid, derived from the skins, and fruit acids, chiefly malic and tartaric.

Natural wines contain only the alcohol produced by the normal fermentation of the natural grape sugar. The proportion varies, according to the strength of the must and the ratio of sugar to protein, but seldom exceeds 16 per cent. Such wines include hocks, moselles, clarets, burgundies, sauternes and champagne.

Some wines are strengthened by the addition of spirit, and they are then known as fortified wines. Examples are ports, some sherries and madeira. In "dry" wines the fermentation has proceeded to the utmost limit, reducing the sugar to nothing or at most to very small content. Examples of dry wines are hocks, clarets and some champagnes. In sweet wines the fermentation

proceeds only to a limited point, leaving a notable quantity of unfermented sugar. Some sherries, port, marsala and some champagnes are varieties of sweet wines.

In sparkling wines secondary fermentation is allowed to take place in the bottle, and the resulting imprisoned gas (CO_2) produces effervescence when the wine is poured out. The principal sparkling wine is champagne, but varieties of moselle and burgundy are also of this character.

The actual food value of wine, apart from the alcohol content, is negligible. The dietetic value of wines depends partly on gustatory properties, which lend a pleasing accompaniment to a meal, and on the alcohol content which by its inhibitory action on the higher brain nerve centres lessens cerebral and arterial tension.

[Topical

AT WORK IN THE KENTISH HOPFIELDS

Training the hop-vines which supply an important basis in the manufacture of beer.

The following table gives the percentages of alcohol in some common wines.

Wine.	Average Alcohol % by vol.
Clarets	9.12
Bordeaux White	8.10
Hock	10.00
Moselle	10.00
Italian Red Wines	10.12
Spanish Wines	10.12
Californian Burgundy	10.12
Australian Burgundy	12.15
Champagne	10.15
Madeira	16.18
Sherry, Dry	18.00
Sherry, Brown	22.00
Port	20.00
Marsala	20.00

The wines from different countries and special districts in the same country have special properties in bouquet, flavour and physiological effects, depending on the composition of the grape, determined by climatic conditions and the character of the soil, and appealing to individual tastes, but in the main their dietetic influence is very much on a par. The best wines for ordinary consumption with meals are the natural wines, with an average of from 10 to 12 per cent. of alcohol. These give the physiological effects without excess of alcohol content.

White wines are generally best for those who have weak digestions as the tannin content is lower. Sparkling wines give the best tonic effect. The fortified wines like sherry, port, madeira and marsala, are not

suitable for ordinary mealtime beverages, and should be reserved for aperitifs and after dinner consumption, to be taken in strict moderation.

At the meals during working hours wine should be taken very sparingly or omitted altogether. Its specific action is best exerted at the evening meal after the day's work is over, when the system welcomes physiological relaxation from the strenuous mental or manual work of the day.

Spirituous liquors comprise whisky, gin, brandy and rum. They are prepared by distillation and condensation from alcoholic liquids like beer wort, wine and molasses. In the process of distillation and condensation the alcohol is separated in great strength from the fermented liquor, and such spirits have therefore a high alcoholic content.

Whisky.

Whisky is the popular spirit and may be defined as a spirit made from malt or malt and grain, and distilled in pot-stills. Genuine Scotch whisky is prepared entirely from barley malt. Irish whisky is distilled from worts that contain unmalted barley or maize as well as malt. The pot-still is universally employed in the manufacture of whisky and represents a very simple form of distillation, carried through in two or three operations.

During the distillation, in addition to ethyl alcohol, a number of secondary products come over which give characteristic aroma and flavour to the spirit. These include acids, aldehydes, furfurol, ethers and higher alcohols, the chief of which are amyl and butyl alcohols, forming the so-called fusel oil. Some of these secondary products like the ethers may be considered to be desirable, but others, for example, the furfurol, are deleterious. Freshly distilled whisky is crude and harsh in flavour, and is not fit for human consumption.

When matured in wood many changes take place which are not well understood. The harshness is decidedly modified and bouquet and flavour are developed. There is a gradual formation of aldehydes, acids and ethers from the higher alcohols, and the deleterious furfurol is gradually broken down. Most authorities are agreed that whisky requires at least five years' maturation in wood before it is fit for consumption. (Note : Whisky does not mature in glass).

PATENT STILL WHISKY.—In Coffey's patent still the rectifier removes most if not all of the secondary constituents so that the product is practically pure ethyl alcohol. This form of spirit is known as patent still or silent spirit, as it lacks the flavour of pot-still whisky and is used extensively for blending purposes, especially in the case of immature whiskies. It may be produced from worts fermented from any kind of grain or sugar.

Gin.

Gin is the colourless spirit distilled from worts fermented from malt and rye, and sometimes maize, by several operations. Usually flavouring substances are added before the final distillation, including juniper berries and other essential oils, according to the practice of the individual distiller. There are some gins, however, that do not contain these flavouring bodies. In common with whisky, crude gin is unfit for human consumption and undergoes the same changes on maturation. Gin is not consumed in this country largely as a general beverage, but is mainly employed in the compounding of aperitifs and cocktails.

Brandy.

Brandy is the spirit distilled from fermented grape juice and is extensively produced in all wine producing countries. The distillation is effected by modified pot-stills, and the aroma and flavour of the product are reminiscent of the wine from which it is prepared. In common with whisky and gin, crude brandy is unfit for human consumption, but on maturation it becomes mellow, and characteristic aroma and flavour are developed. There is comparatively a much higher production of ethers than in the case of whisky, and this probably accounts for the special medicinal value of brandy.

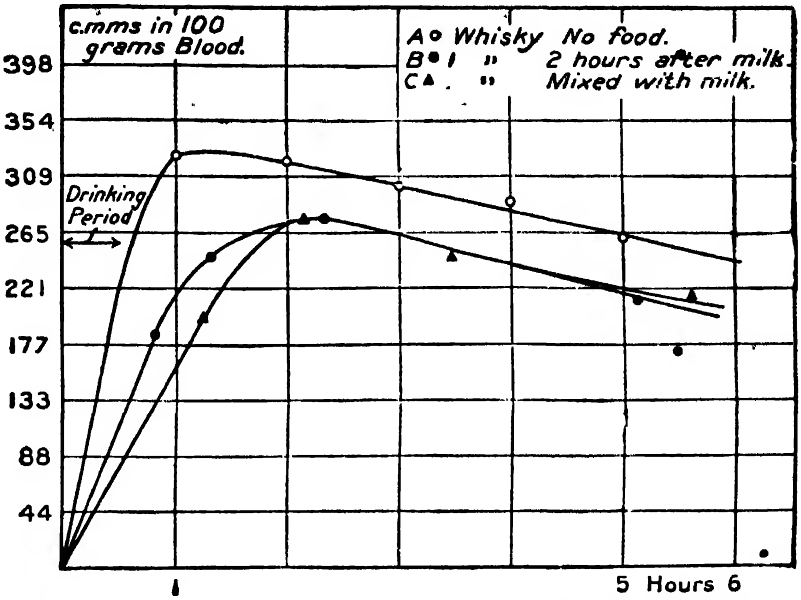
Rum.

Rum is generally distilled from fermented molasses, a by-product in the manufacture of cane sugar, but the higher qualities are prepared direct from the fermented juice of the sugar cane. It is a very potent spirit, the alcohol and ether

content being high, but it contains considerable quantities of furfurol. On maturation the crudities of the raw spirit are toned down, and genuine old Jamaica rum is mellow and has a very full characteristic bouquet and flavour.

The following table gives the original average proportion of alcohol in different spirits :—

	Per cent. of Alcohol by Volume.
Scotch Whisky ..	50
Brandy	48
Gin	47
Rum	70



Courtesy] [Prof. Mellanby and the Royal Society of Medicine

THE BEST TIME TO TAKE ALCOHOL

Showing how much more rapidly alcohol is absorbed into the blood when taken on an empty stomach than when taken with or after food.

These strengths may be broken down, as in the case of whisky, to meet the current government regulations.

When spirit is used as a basis of a beverage it is most important that it should be well diluted with plain or mineral water, bringing the alcoholic strength down to about 10 to 15 per cent. by volume. When alkaline minerals are used they serve the useful purpose of neutralising acidity.

Spirits contain no solid residue and are thus useful where the physiological effect of alcohol is desired without the carbohydrates that are present in beer and sweet wines. Generally speaking, the physiological effect is more potent and rapid than in the case of malt liquors. Dietetically the best whisky is a well matured, all malt, pot-still spirit. This gives a full bouquet and flavour with reasonable assurance of the elimination of the crude and harmful products that are present in the raw whisky.

Cider.

Cider, "the wine of England," is prepared from the fermented juice of apples and is increasing enormously in popular favour. During recent years the cider apple strains have been greatly improved and the processes of manufacture brought to a high state of perfection. The chief cider-producing counties are Hereford, Somerset, Devonshire and Norfolk.

There are three varieties of cider, sweet, dry and sparkling. In the still, sweet cider, the fermentation is stopped by suitable means before the total sugar is converted into alcohol, leaving considerable quantities in the beverage. In the preparation of "dry" cider the fermentation is carried through to a more advanced stage, with the result that only small quantities of sugar remain in the liquor. Sparkling cider is prepared by allowing the liquor to undergo a secondary fermentation in the bottle, resulting in the production of gas (CO_2) which aerates the contents, and causes effervescence on decantation.

PERRY is a similar beverage prepared from pears.

In addition to alcohol, cider contains notable quantities of fruit acids, chiefly malic and tartaric, and also fruit salts. As a beverage cider possesses certain well-marked characteristics, and all authorities are agreed that it is a refreshing drink with a low alcohol content, having many of the

characteristics of grape wine. Some dietitians maintain that it is a very suitable beverage for gouty and rheumatic subjects, and that the alkaline salts and vegetable acids present confer slightly diuretic and aperient properties, and counteract the acidity of the blood and urine. Cider and perry contain vinous ethers which increase on maturation exactly as they do in champagne.

The general composition of standard cider is well exemplified in the following analyses of the Gaymer Norfolk Ciders given by the *Lancet*, June, 1925 :—

	Total Solids.			Volat Acid as Ac	Fi Ac as
	"		%	%	%
Pommetta (Champagne type)	6.87	5.55	4.52	0.07	0.78
V D (Dry) ..	7.00	4.55	4.82	0.05	0.64
N (Extra dry)	4.25	4.25	4.53	0.07	0.67
One Star (Sweet)	8.86	2.57	7.64	0.04	0.45

A very dry cider VD (still) suitable for mixing with mineral or medicinal waters, and specially adapted for gouty, rheumatic and diabetic conditions gave the following figures (Campbell) :—

	Alcohol by Volume.	Sugar.	Volatile Acidity as Acetic.	Fixed Acidity as Malic.
V D (Still special reserve, hock type)	3.38	0.31	0.04	0.52

FOOD VALUE OF ALCOHOLIC BEVERAGES

The food value of alcoholic beverages lies in the caloric yield of their fuel constituents, inasmuch as tissue forming principles are absent. They are therefore sources of energy only.

The fuel foods are : (*a*) alcohol ; (*b*) carbohydrates in the form of dextrins and sugar.

There is a wide divergence of opinion among experts on the exact food value of alcohol. and the pros and cons cannot be fully discussed within the limits of this article. The writer therefore confines his remarks to a statement of facts so far as they are known.

In the first place it is necessary to correct the general idea that alcohol is a stimulant. On the contrary it is a powerful inhibitory agent acting with great rapidity on the nerve centres. It produces its characteristic effects by inhibiting the control of certain subordinate nerve centres which exercise during normal life an influence modifying the rate of the heart's beat, governing the calibre of the minute arteries and the co-ordination of voluntary muscles.

The slight quickening of the cardiac beat, for example, after the ingestion of alcohol is not due to direct stimulation of the cardiac system, but to the damping down of a nerve centre which habitually exercises a "braking" effect on the heart's beat. The lessening of this action is like taking off a brake, with a resulting acceleration of pace.

In a similar way the dilatation of minute blood-vessels under the action of alcohol is due to the inhibition of a nerve centre which actuates and governs their tonicity. When this centre is " damped down " by alcohol the nervous action which keeps the blood-vessels more or less in contraction is lessened and they therefore dilate, reducing blood pressure for the time being and easing the work of the heart. In the case of the higher cerebral centres the inhibition is manifest in a lessening of the cerebral tension which in our daily life controls the mental processes and actions, and by constant guard brings them into uniformity with convention, education, moral training, environment and business. The slight lowering of this higher mental tension such as is produced by harmless doses of alcohol, brings about a feeling of well-being and relief, smoothing out irritability, and generally enables the individual to look out on life at the moment with amiability and tolerance.

This mental relaxation is specially evident and welcome when the working day, involving high nervous tension and mental concentration, is over, and under the action of small doses of alcohol the mind is left free to enjoy the lighter side of life.

In a report published in 1916, drawn up by a committee of the Royal Society at the

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THE GRAPE HARVEST IN SPAIN

Vineyard workers in the province of Estremadura carting the newly-gathered grapes to the press-room, where they are crushed before fermentation takes place.

request of the President of the Board of Trade, fully representing the opposing views, the following conclusion is given, on page 34:

"Accurate experiments have shown that alcohol, if taken in moderate doses, up to the amount contained, for example, in one quart of beer (two ounces of alcohol), is very completely burnt up in the body, the proportion which under these circumstances escapes unchanged being at the most 5 per cent.

"This combustion of necessity liberates energy in the body. . . . Quantitative observations on nutritional balance have shown moreover that this energy need not be lost as waste heat, but can be made to support the active functions of the body. This being so, a moderate quantity of alcohol may, if the conditions serve, actually take the place in nutrition of a dynamically equivalent quantity of fat or carbohydrate. Were it not possessed of other qualities, the food value of alcohol would, therefore, be measured by its full caloric value. But, unlike other foodstuffs more strictly defined, alcohol exerts effects as a drug which cannot be ignored in appraising its value as a food.

"These effects become more important when the individual is called upon to do strenuous work or to endure exposure."

The caloric value of 1 grain of alcohol is 7. Taking the loss at 0.5, the net food value is 6.5 calories per grain or 184 calories per oz.

In *Alcohol—Its Action on the Human Organism*, published in 1916 by the Central Control Board (Liquor Traffic) under the signature of a committee of eminent physicians and physiologists fully representative of the opposing schools, the following conclusions are arrived at (pages 27 and 28) :—

(1) Alcohol is completely and rapidly absorbed from the stomach and intestines.

(2) A small but variable quantity of alcohol escapes unchanged in the breath and urine. The rest disappears in 24 hours after ingestion.

(3) The disappearance of alcohol from the body is due to its being oxidised. None of the alcohol is known to be converted into any substance which the body can store.

(4) The energy liberated by the combustion of a moderate amount of alcohol can be used by the body to its full value.

(5) Alcohol can, within limits, replace an equivalent amount of carbohydrate or fat in the diet and has a similar effect in economising proteins.

(6) The whole food value of alcohol is due to its use by the body as fuel.

On pages 28 and 29 it is again pointed out that the drug action must be taken into consideration.

From this it appears that we are entitled to assume that within certain quantitative limits, alcohol is completely oxidised in the body as an immediate source of energy and that, provided the amount taken is not in excess of the figure that the body can use, the drug (narcotic) action does not reach the stage that involves harmful results. The final products of the oxidation of alcohol in the body are water and carbon dioxide.

The amount that the body can completely utilise without leaving an unoxidised surplus in the blood and tissues is variable. It will depend on the kind of life the individual leads, whether in the open air or sedentary, and the amount of muscular work performed. There is some consensus of opinion that for sedentary and light indoor manual workers, two ounces is the maximum quantity in 24 hours. But probably an outdoor worker, or a man engaged in very hard manual labour, would be able to utilise fully considerably more. This quantity of alcohol (2 oz.) is contained approximately in: 2 pints of beer (original gravity 1042.6); 3 pints of mild ale (original gravity 1037.8); 1 pint of natural wine; 1 gill of spirits.*

When the amount of alcohol exceeds the datum quantity per day for a particular individual, all authorities are agreed that the drug action is manifest, the intensity increasing *pari passu* with the surplus taken.

†Drug Action.

Whatever views are held on the moderate consumption of alcohol, there can be no question that continued excessive use is harmful and in the extreme limits leads to serious disease. But it may be said *en passant*, though not with such force, that continued excess in the consumption of even basic foods leads to nutritional metabolic disturbances, and in many cases favours the incidence of actual disease.

Alcohol differs from the other energy foods in that it is directly oxidised and cannot be stored, like the carbohydrates and fat, in the tissues for future use. It thus acts solely as a readily available fuel food, sparing the glycogen, fat and protein to the extent of the given energy liberated. A reasonable view of the subject, however, negatives the conclusion that alcoholic beverages are mainly used on account of their food value, though when, as in the case of beer, the alcohol calories are added to the carbohydrate and protein value, malt liquors have a distinct nutritional place in dietary.

Most people indulge in alcoholic beverages because of their agreeable gustatory properties, and the pleasant relaxative effects on the nervous and circulatory systems, which at the end of the day have been tuned up to a high degree of tension by harassing daily mental effort or laborious manual work.

On page 132 of the report the committee say:—

"We deal here solely with the physiological aspect of the alcohol question, and our consideration of this aspect leads us to recognise that the agreeable effects which the majority of people experience from the use of alcoholic beverages can be produced by doses of alcohol, moderate in quantity and taken in adequate dilution and at sufficient intervals, which will not in normally constituted persons be attended with appreciable risk to physical or mental health.

"We are dealing solely with the physiological facts so far as it is possible to ascertain them in the present position of knowledge, and within the prescribed limitation we can only say that the moderate use of alcoholic beverages is physiologically permissible only as long as it conforms to the special conditions which we have seen to be necessary in order to avoid the poison action of the drug."

* From *Alcohol—Its Action on the Human Organism*, Appendix 5.

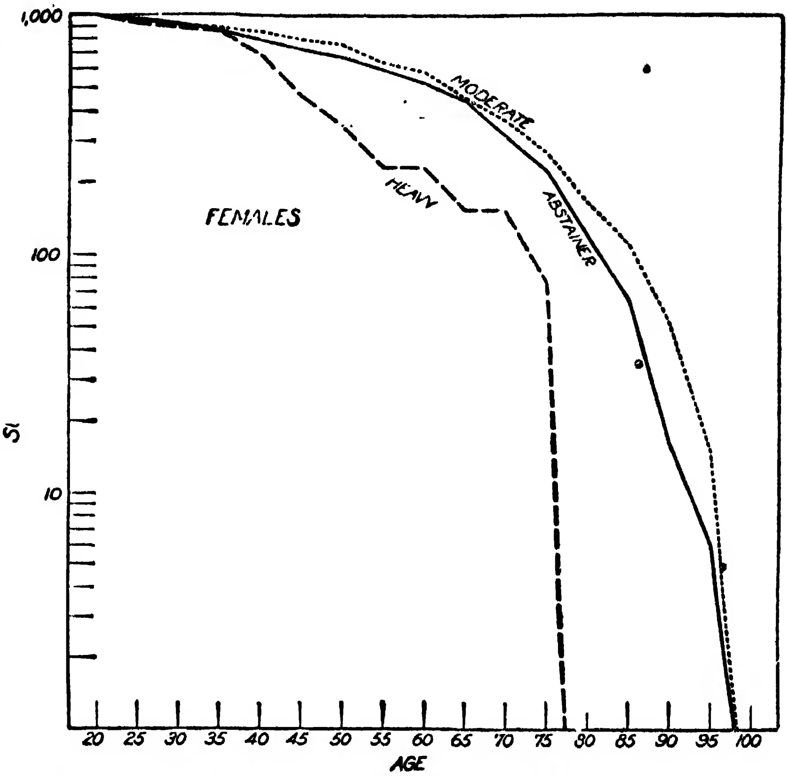
† See section on "The Mind."

They formulate certain propositions, and experience conclusively shows that these are in the main the general habits of the masses in relation to alcoholic beverages :—

(1) To avoid continued action on the tissues such an interval should elapse between the times when alcoholic beverages are drunk as will prevent persistent presence of a deleterious amount of alcohol in the body.

(2) To avoid direct injury to the mucous membrane of the stomach, alcohol should not be taken in concentrated form and without food.

This is only another way of saying that alcoholic beverages should be taken in strict moderation and in the diluted form of beer, natural wines, cider, and spirits with water or minerals, and that, generally, drinking between meals on an empty stomach should be avoided. Most people take their alcohol as an accompaniment to their meals and thus conform to the principles laid down.



Courtesy] [" *The Action of Alcohol on Man*," E. H. Starling (Longmans, Green & Co.)

ALCOHOL AND THE SPAN OF LIFE

A diagram from actual figures showing the length of life of women of different drinking habits and emphasising the shorter average life of heavy drinkers.

On page 133 the whole matter is summed up as follows :—

" The temperate consumption of alcoholic liquors in accordance with these rules of practice may be considered to be physiologically harmless in the case of the large majority of normal adults ; and this conclusion, it may be added, is fully borne out by the massive experience of mankind in wine and beer drinking countries.

" On the other hand, it is certainly true that alcoholic beverages are in no way necessary for healthy life ; that they are harmful or dangerous if the above mentioned precautions are not observed ; and further that they are definitely injurious to children and for most persons of unstable nervous systems, notably for those who have had severe injuries to the head, or who have suffered from attacks of mental disorder or nervous shock."

It appears then that the individual can exercise a personal choice of beverage in favour of alcoholic liquors without the slightest danger of deleterious effects, provided he or she conforms to the same temperate principles that govern general diet and habits.

MALT LIQUORS have a food value in addition to the alcohol content dependent on the percentage of dextrin and sugar present. The values are 1 gram of alcohol equals 6.5 calories ; 1 gram of carbohydrate equals 4.1 calories. The English equivalents are : 1 oz. of alcohol equals 184 calories ; 1 oz. of carbohydrate equals 116 calories.

Caloric Values.

A pint of fine, good, malt liquor contains

approximately: alcohol, 1 ounce; carbohydrates with traces of protein, 1 ounce. The total calories would work out on these figures at 300 calories. Many light ales and beers would work out below this figure, while heavy stout and ales and special proprietary malt liquors would give much higher results.

Assuming the optimum of alcohol to be 2 ounces per day, one quart of good malt liquor would yield 600 calories, i.e., one-fifth of the total amount required (3000) by an adult under ordinary conditions of life.

Hard workers would probably be able to take more than this quantity without a surplus of unused alcohol remaining in the blood and tissues. The capacity of the body for the metabolism of alcohol is, however, strictly limited over periods, and it is probable that if the total optimum were ingested in one quantity there would not be complete oxidation.

WINES.—The caloric value of dry wines depends mainly on the alcoholic content. The sweet wines have a slightly higher value on account of the presence of varying proportions of sugar. The figures for one pint of natural wine vary between 350-380 calories. Hocks, moselles and clarets give the lowest values while burgundies, sweet sauternes and champagne give the highest. Fortified wines like port, sherry, madeira and marsala have a higher caloric value on account of the excess of alcohol and the presence of sugar. But against this is the fact that these wines are only consumed in small measures and not taken generally as beverages.

SPIRITS.—The caloric value of spirits depends entirely on the alcohol content. For the optimum of two ounces to be completely utilised by the body the spirit must be taken in appropriate dilution and at suitable intervals during the 24 hours. The optimum of 2 ounces contained in about a gill of spirit would yield 368 calories.

It is important, however, to note that, especially in the case of wines and spirits, the food value is usually of only incidental importance. These beverages are mainly taken for their gustatory effects and the pleasant sense of well-being which they engender on the temperament, and as a pleasant enjoyable concomitant to a well-served meal.

[*Sport and General*

A DEVONSHIRE CIDER ORCHARD
Cider apples ripening in an orchard at Totnes.

A VINEYARD IN THE MOSELLE DISTRICT

Matthew Arnold has well said that "Alcoholic beverages used in moderation add to the agreeableness of life, and whatever adds to the agreeableness of life adds to its resources and power."

Alcohol has no vitamin value and therefore wines and spirits do not contain vitamins.

Vitamins. Malt liquors, however, contain water-soluble vitamin B concerned in the nutrition of the nervous system, the promotion of tissue growth and the maintenance of normal bowel action.

Barley malt and the wort produced therefrom contain vitamin B. A large part of this wort vitamin B passes into the propagating yeast, and a smaller portion into the beer. In the *Bio-chemical Journal*, Vol. xxiii., No. 5, 1924, Dr. H. W. Southgate gives the result of his researches into the vitamin B value of beer and malt, and concludes that beer contains vitamin B, independently of its yeast content, but not so much as in the corresponding amount of malt used in its manufacture. In those bottled beers which contain a yeast sediment the vitamin value is correspondingly increased. On this account the sediment should be ingested with the liquor and not left as "grounds" in the bottle.

For the physiological action of alcohol and its drug effects in excess, see the section on "The Mind."

WINE AND HEALTH

By ANDRÉ L. SIMON

Author of "The Art of Good Living," etc.

WINE, like fire, like speech, like everything that is most necessary, may be abused or misused, but it remains nevertheless what it has ever been among the more civilised nations from the dawn of history to this day, the most wholesome beverage for all healthy adults.

Wine is wholesome because it is a natural product, the naturally fermented juice of fresh grapes. It is an admirably well-balanced aqueous solution. Water is by far the most important part of all wines, as regards bulk; there may be as much as 90 per cent. of water in a wine and as little as 7 per cent. of ethyl alcohol, but even this small proportion of alcohol is sufficient to keep out of the wine all dangerous bacteria which thrive in water and in milk.

Of course, wine is no mere blend of much water and a little alcohol. Far from it. It contains a number of other substances, in

very small quantities and yet responsible for the charm, the individuality and the dietetic value of different wines. All such substances are either of mineral or vegetable origin; they have passed into the wine from the soil upon which the grapes grew (mineral salts), or from the grape juice itself (unconverted grape sugar), or else they are the by-products of fermentation (volatile ethers). They are all perfectly natural, and the harmonious manner in which they are all blended together is one of Nature's most admirable miracles.

Wine which is sound and taken in moderation is equally beneficial to nerves, blood circulation and digestion; it soothes and stimulates in turn, and so gently that there is no reaction to be feared; it leaves behind no morbid craving for more. Wine-drinking nations are the most sober nations, and drunkards drink no wine.

Of course, in the matter of food and drink, the personal factor is all important. An egg is a perfect meal in itself, and yet there are people to whom an egg is poison. There are also people to whom the best wine is poison. But what makes wine so valuable a beverage, a tonic, a food and a stimulant, is that there are so many varieties that, if one only knew, one could find the type and style of wine suited to the personal idiosyncrasies of each one of us.

There are young and old wines, red and white, still and sparkling, light and heavy, rich and sharp wines; they vary according to the species of grapes from which they are made, according to the nature of the soil and of the vineyards; to climatic conditions and the state of the grapes at the vintage time; to the way the grapes are gathered and pressed; to the manner in which the fermentation of the newly pressed grapes takes place; to the way the wine is cared for in cask or in bottle, and to the length of time during which the wine is allowed to mature.

With a little care and the assistance of the true wine merchant, one who really knows his business and deserves his clients' confidence, it is possible to choose from the practically endless varieties of wines, just the wine which is suited to every occasion and to every individual, wine which will make our meals more enjoyable and more beneficial, our friends and ourselves better and happier.

TEA

By JOHN CAMPBELL, Ph.D.

TEA is the most popular of the infused and cooked beverages, and when properly prepared from good quality leaves and taken in moderation it forms a harmless exhilarating beverage, acting as a stimulant to the cerebral and cardiac centres and lessening the sensation of mental fatigue.

The Raw Leaves.

Either by hand or machinery the raw leaves undergo a process of withering, fermentation (black tea only—green tea is unfermented), roasting and rolling, and during these operations considerable changes are effected in the composition of the original leaves.

(1) The water content is reduced from 75 per cent. to about 9 per cent.

(2) The volatile and essential oils present are modified and developed, giving flavour and aroma.

(3) Tannic acid is rendered less soluble and in part dissociated.

(4) In black tea during the fermentation there is enzyminic action on various constituents, during which the green colour is deepened to black.

The following table gives a comparison of the percentage differences of composition of tea before and after the roasting operations:

Components of Tea.	Original Leaves	Green Tea Unfermented.	Black Tea Fermented
Protein	37.35	37.43	38.90
Essential and Volatile Oils	6.49	5.52	5.82
Caffeine	3.30	3.20	3.30
Tannic Acid	12.91	10.64	4.89
Gums, fibre, cellulose and other non-nitrogenous substances	34.98	38.29	42.16
Ash	4.97	4.92	4.93
	100.00%	100.00%	100.00%

The most important fact that emerges from these analyses is that during the fermentative process in the preparation of black tea,

nearly two-thirds of the tannic acid is converted into more highly oxidised substances and becomes less soluble.

The following table gives average percentage composition of black Congou and green Hyson tea (Bannister).

Components of Tea.	Congou (Black).	Hyson (Green).
Water	8.20	5.96
Caffeine	3.24	2.33
Protein	17.90	17.63
Gums	2.60	3.72
Tannic Acid	16.40	27.14
Volatile Oils	6.79	7.05
Ghlorophyll and Resin	4.60	4.20
Cellulose	34.00	25.90
Ash ..	6.27	6.07

THE TEA PLANT

The flowers, and the leaves from which the beverage is made.

Varieties and Blending.

CHINA TEAS are characterised by delicate flavour and contain the minimum quantities of tannic acid. They are therefore the least astringent.

INDIAN ASSAM TEAS have a full flavour and contain more tannic acid than China teas, and more gum and other soluble organic constituents, and therefore have more " body," giving a syrupy infusion.

CEYLON TEAS possess a characteristic flavour and stand mid-way between China and Assam teas in astringent qualities.

On the other hand, the INDIAN DARJEELING teas in the highest qualities are comparable in flavour and mildness to China tea.

JAPAN TEAS are mostly of the green variety and are pungent in their character, containing high percentages of tannic acid. They are often used for blending purposes.

Teas thus vary in their outstanding individual qualities and the art of tea blending is to combine different teas so as to give in the infusion a good balance of the stimulating, aromatic, flavouring and syrupy properties. Some teas are taken for the high percentage of caffeine and low percentage of tannic acid, others for aroma and flavour, and others again for " body." By properly apportioning the weights of these different teas in a blend, an infusion is obtained giving an agreeable combination of stimulating and gustatory qualities.

The character of " local water " has often a marked effect on the infusion, and special blends are commonly produced to suit the properties of district water.

Selection of Leaves.

The quantity and proportion of caffeine and tannic acid and enzymes in tea vary within wide limits, not only in tea from various countries but also in leaves picked from the same plant, according to age, and also in different parts of the same leaves.

China tea generally contains the least proportion of tannic acid and the young leaves of the shrub the lowest percentage of all, especially in the areas round about the tips. High qualities of tea from the health standpoint are represented in the young leaves, and a still superior quality in the points only.

Inferior tea contains the older and coarser leaves with often the mid-ribs and stalks, and gives an infusion poor in exhilarating properties, with an excess of those harmful constituents that exert inhibitory effects on gastric digestion.

The Infusion.

When tea is infused with boiling water the strained liquid contains the following constituents :—

(1) Caffeine.—This alkaloid imparts the stimulating properties to the beverage.

[Topical

AT WORK ON A TEA PLANTATION
Spraying the tea plants on a hillside at Nagri, India.

(2) Tannic acid.—This is an astringent acid forming a series of organic salts with protein. It precipitates the active ferments of gastric juice, thus delaying digestion. Habitually taken in excess, especially without food, it acts injuriously on the mucous membrane of the stomach. It may be looked upon as the deleterious constituent of tea.

(3) Volatile aromatic oils that confer flavour and aroma.

(4) Gummy and colouring matter, including dextrin, resin, pectin and other extractives which give "body" to the infusion.

The initial consideration is to use tea of good quality. Rather drink less tea prepared from good quality leaves than indulge more freely in the cheaper blends.

The objects to be aimed at are to obtain the maximum percentage of the stimulating caffeine and aromatic oils with the minimum quantity of the harmful tannic acid. In this relation advantage may be taken of the fact that the caffeine passes into solution very much more rapidly than tannic acid, in the form of caffeine tannate. In a *short* period of infusion, therefore, a solution is obtained relatively rich in combined caffeine and oil, and poor in the deleterious uncombined tannic acid, which remains behind in the leaves.

The following analyses (W. Green) illustrate these points very clearly :—

COMPOSITION OF TEA INFUSION

	5 min.	10 min.	20 min.	40 min.
	per cent.	per cent.	per cent.	per cent.
Total Extract	21.78	25.38	26.81	28.14
Caffeine	1.11	1.30	1.16	1.18
Tannic Acid	6.85	8.52	11.73	16.32

The quantities used were 3.5 grammes of tea and 422 c.c. of boiling distilled water. It will be observed that after the first five

minutes there is very little increase in the proportion of caffeine while on the other hand the percentage of tannic acid steadily rises.

Infusion beyond five minutes only results in increasing the percentage of tannic acid, thus converting a harmless stimulating infusion into a harmful beverage with distinct inhibitory effects on digestion. Recent determinations show that after only two minutes' infusion most of the available caffeine has been extracted.

To prepare tea :—

How to Prepare Tea.

(1) Use tea of good quality.

(2) Allow one heaped teaspoonful of leaves for each person for two cups.

(3) Use two heated teapots, one for the infusion and the other for storage on a hot plate or under a cosy.

(4) Use the water just after it has reached the boiling point and pour into the pot while still boiling. Use sufficient water for the entire number of cups to be served.

(5) Infuse Indian and Ceylon teas for three minutes; China teas for five minutes.

When infusion is completed, pour through a strainer into the second *hot* teapot. This may stand for any length of time without increase of harmful properties. A single teapot may be used if an "infuser" is employed which allows the exhausted leaves to be raised or removed from the infusion, or by altering the position of the teapot the liquor is drained to the bottom beneath the leaves. Allowing the leaves to remain in the pot for another "brew" is wrong. The second cup is devoid of stimulating properties and is astringent and bitter according to the length of the time of extraction. When a single tea pot is used without an infuser, only sufficien tea should be made for one round of serves using a flat teaspoonful for each cup. I second cups are required, a fresh brew shoulc be made.

The addition of milk to tea, though it may mask the true flavour, is distinctly beneficial from the dietetic standpoint. The lactalbumen and casein of the milk combine with the tannic acid to form organic salts, thus neutralising its astringent and precipitating properties, rendering the tea more healthful, besides giving it nutritive and caloric value.

[*Sport and General*

TEA TIME

Though the nutritive value of tea is negligible, the beverage is very useful for its refreshing and stimulating effects.

According to most recent investigations, black tea contains no vitamin, but Dr. Murlin in a series of researches undertaken for the Japan Tea Promotion Committee, conducted at the Medical School of the University of Rochester, New York, indicates that Japan green pan-dried tea contains vitamin C in sufficient quantities to prevent the onset of scurvy in guinea pigs.

Vitamins.

Dr. Murlin gives the following figures: 15 c.c. of a 2 per cent. five-minute infusion of pan-dried green tea is equivalent to 1.5 c.c. of orange juice or 2 c c. of lemon juice in its anti-scorbutic effects. The Russian method of adding lemon juice to the pure infusion is quite good as it adds vitamin C to the beverage.

The nutritive and caloric value of the pure infusion of tea is negligible, but this has no dietetic significance as tea is taken solely for its stimulating effects. When milk and sugar are used, the nutritive and caloric value are raised by the equivalents of the weights used.

Dietetic Value.

Tea may be regarded broadly as a necessity of modern life and in its proper place, in moderation, it is a dietetic accessory, to be enjoyed and appreciated as a delightfully refreshing beverage, adding notably to the joy of living. Like many other of our food adjuncts, if taken immoderately, or badly prepared, it will produce deleterious effects, as caffeine is a powerful alkaloid and in excess adversely affects the nervous system and heart. Prepared in the proper way, tea is a harmless nervine stimulant, giving a welcome fillip to the jaded brain at times of the day when it is most needed.

There are certain physiological conditions, however, in which care is needed in the use of tea generally. Very young children are better without it, and in the case of the older children it should be served weak with plenty of milk. Adults of nervous temperaments should take it sparingly.

In case of weak digestion, China tea prepared from the tips of young leaves, infused for short periods, will be found best, and many people who have had to sacrifice the cheering effects of a cup of tea on account of dyspeptic troubles will find their problem solved by this selection.

COFFEE

By JOHN CAMPBELL, Ph.D.

THE coffee bean is the roasted fruit of a shrub of the Genus *Coffea*. After being separated from the pods by maceration, the beans are allowed to undergo a spontaneous fermentation in tanks, and then washed and dried either in the sun or in hot air rotary machines.

After "hulling" by drying, roller pressure and winnowing, the beans are polished and graded ready for export to the coffee consuming countries.

The chief coffee producing areas are: South America (Brazil, Venezuela, Ecuador); West Indies (St. Domingo and Hayti); East Indies (Ceylon, Java, Mysore); Mexico; Arabia.

The coffee from each of these countries possesses individual characteristics in addition to the general dietetic and physiological properties that are common to all coffees.

The South American coffees are somewhat lacking in the volatile oils that give rise to aroma and flavour, but contain a full content of the stimulating principle (caffeine) and a high percentage of the soluble organic constituents giving body.

Arabian coffee (Mocha) is very rich in the aromatic oils, and produces the best infusion for flavour and aroma. In the same way that different teas are blended to give specific gustatory characteristics, so coffees from different areas are mixed to secure the same result.

The coffee beans are prepared for infusion by roasting and grinding. The roasting operation has a most important influence on the quality of the coffee, especially in relation to aroma and flavour. If the chemical action is carried too far the resulting coffee lacks flavour by loss of the volatile constituents. Under-roasted coffee also lacks flavour on account of restriction in the development of the aromatic oils.

Roasting.

The roasting of coffee is now generally carried out in rotating perforated discs over gas, and usually superintended by experts, who are able to regulate the heat and time of action according to the kind of bean being roasted, and to stop the cooking at the right point, giving the maximum combination of flavour and stimulating properties.

During roasting, gasses and steam are formed in the beans which swell and become more or less crisp. The coffee is profoundly modified during this action. Most of the water is evaporated, and some of the fat and caffeine is lost. Part of the sugar is transformed into caramel, giving colour, and the starch is mainly converted into dextrin. A highly volatile substance known as Caffeol is developed from certain of the essential oils which confers a characteristic aroma to the coffee. The total loss amounts to about 20 per cent.

The following analyses give the percentage composition of raw and roasted coffees, and clearly shows the differences noted above :—

	Mocha		East Indian	
	Raw	Roasted	Raw	Roasted
Moisture	8.98	.63	9.64	1 13
Caffeine ..	1.08	.82	1.11	1.05
Sugars	9.55	.43	8.90	.41
Caffeine Acid ..	8.46	4 74	9.58	4.52
Nitrogenous and Colouring Matter	16.77	25.37	15 54	25 80
Fat and Oil ..	12.60	13 59	11 81	13 41
Dextrin	.87	1 24	.84	1 38
Cellulose	37 95	48.62	38.60	47 42
Ash	3.74	4 56	3 98	4 88
	100.00	100.00	100 00	100 00

The proportion of caffeine is less than that found in tea, but the infusion contains usually more on account of the greater weight used in proportion to water.

The best infusion is prepared from freshly roasted and ground coffee, as the aromatic and flavouring bodies are then fresh and at their maximum. Failing freshly roasted coffee, the next best is freshly ground coffee from the coffee nibs. This operation may be easily carried out in the home by the use of an ordinary hand coffee grinding machine. Roasted nibs and ground coffee should be stored in a tight cannister to prevent the

THE COFFEE PLANT
Showing the pods on the branch, and how the beans are arranged in the pods.

evaporation of the volatile flavouring constituents.

The infusion of coffee contains the following constituents in solution :- -

(1) Caffeine, to which the stimulating qualities are due.

(2) Caffeic acid--also designated caffeotannic acid—comparable to the tannic acid of tea.

(3) Fat and volatile oils.

(4) Caffeol, giving flavour and aroma.

(5) Sugar, dextrin and other soluble substances, giving " body " to the liquor.

(6) Caramel, giving colour.

Apart from added milk and sugar, coffee has very little nutritive value. If made with hot milk and added cream the caloric and protein value is considerable. Coffee is, however, like tea, drunk chiefly for the stimulating effect, and as a particularly fragrant breakfast or after meal beverage.

Food Value.

All that has been formulated in the

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COFFEE DRYING IN COSTA RICA

After a period of fermentation the beans are washed and then dried, either in the sun or in hot air machines, before being polished and graded for the market

aroma or flavour which characterises pure coffee. The addition of chicory to coffees lowers the value of the beverage as a nervine stimulant, reduces the aroma and masks the flavour. It, however, adds colour, body and sweetness to the infusion and cheapens the product.

Coffee Substitutes are mainly produced from roasted roots, nuts and cereals. They have nothing in common with genuine coffee, being devoid of caffeine and the essential oils which give the true coffee flavour. They merely produce pleasant beverages simulating the gustatory properties of coffee without the exhilarating physiological effects.

Caffeineless coffee prepared by the H. A. G. process is, however, in a different category, inasmuch as it is essentially a pure coffee, but with the caffeine eliminated, without appreciable loss of aromatic constituents. The infusion is prepared by the usual culinary methods, and is indistinguishable in aroma and flavour from that prepared from ordinary coffee. It contains a slight trace of caffeine and provides this popular beverage without daily nervine and cardiac stimulation. This solves the problem of those who have had to forego the enjoyment of coffee on account of the drug action of the caffeine.

Coffee Extracts are prepared by digesting pure coffee, or coffee and chicory, with water, filtering and evaporating in vacuo to the consistency of thin syrup. Usually caramel is added to give colour.

These extracts are very convenient as the

physiological action of caffeine in tea applies with equal force to coffee. It is primarily a nervine stimulant, but the circulation shares in the quickening effects *pari passu* with the action on the cerebral and medulla nerve centres. The deleterious constituent is the caffeo-tannic acid which acts much in the same way as the tannic acid of tea. (See article on tea.)

Black coffee is best made from ground Mocha nibs, and gives a full aroma and flavour, but should be taken sparingly on account of its astringent characters. White coffee—made with milk or cream—is much softer and milder to the palate, and the astringent and precipitating action of the caffeo-tannic acid is partially or wholly neutralised by the milk proteins and is thus less likely to upset digestion.

Chicory is the ground, dried, roasted root of a species of Endive and is largely used in combination with genuine coffee to form blends. Roasted chicory yields among other constituents, caramel, inulin and invert sugar. Caffeine, fat, aromatic oils and caffeo-tannic acid are absent, so that it has no stimulating properties and does not give the

beverage may be made very rapidly by the mere addition of boiling water, but they lack, of course, the full aroma and flavour of a freshly made infusion from pure ground coffee.

How to Prepare Coffee.

The objects to be achieved in preparing coffee are to obtain a maximum percentage of caffeine and full aroma and flavour.

(1) Use a good quality coffee. Mocha or a good blend of mocha with some of the other varieties, freshly ground if possible.

(2) Use two earthenware coffee-pots or lidded jugs which should be well heated before use.

Courtesy] [*"Good Housekeeping"*

A SIMPLE WAY OF MAKING GOOD COFFEE

Stand two jugs in boiling water over a gas-ring. Place milk in one jug and freshly ground coffee (1 to 2 oz. to the pint) in the other. Pour boiling water on the coffee and stir for 5 minutes, then leave it to infuse for 15 minutes before pouring off.

(3) Allow at least 1 oz. to 2 oz. per pint of water according to strength required.

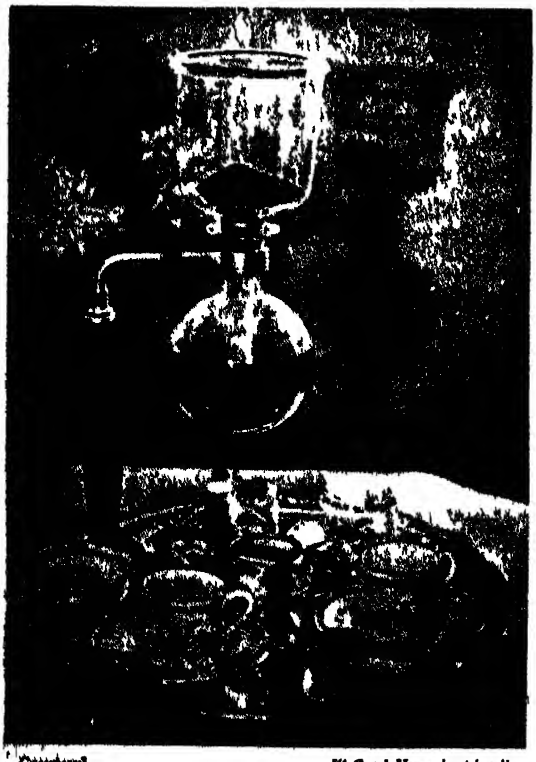
(4) Put the coffee into one of the hot, dry pots and infuse with water that has just come to the boil.

(5) Infuse for five to eight minutes, stirring once a minute after adding the water. Keep the vessel closely lidded.

(6) When infusion is complete, pour through a strainer into the second jug and keep hot and closely lidded until served.

Coffee made in this way will contain from 80 to 90 per cent. of the available caffeine with a full aroma and flavour. There are many special percolators fitted with spirit lamps on the market for making coffee, the most common method being extraction of coffee in an upper chamber by a constantly returning stream of boiling water. On the completion of the percolation and the removal of the lamp, the coffee flows to and remains in a lower chamber, in which it is free from contact with the exhausted grounds.

Mechanical percolators are very convenient, the only drawback being that there is always the danger of excessive infusion from neglect to time the action properly.



Courtesy] [*"Good Housekeeping"*

A MODERN COFFEE PERCOLATOR

A good method of making after-dinner coffee in the drawing-room.

The coffee then becomes bitter and astringent, and has a deleterious action on digestion.

Coffee, when properly made and taken at suitable times in moderation, is a valuable and exhilarating, harmless beverage, fragrant, and most welcome to the palate. It is best taken with milk or cream, black coffee being reserved for after dinner. It is suitable for breakfast, and as an after meal stimulant, and at those times when a fillip is needed for the nervous system after strenuous mental effort.

Coffee—except in very weak infusion with milk or cream—is not suited to those who have weak digestions, and in these cases a coffee substitute might with advantage be used as an alternative. In certain nervine and cardiac conditions coffee may be also contra-indicated on account of the caffeine content, and in these cases medical opinion should be sought before including it in the daily dietary.

In these cases the caffeineless coffee mentioned previously is suitable.

COCOA

By JOHN CAMPBELL, Ph.D.

COCOA stands in a somewhat different category from tea and coffee, as the powder from which the beverage is prepared contains notable proportions of actual food material in addition to the stimulating properties.

Cocoa is prepared from the seed of the *Theobroma Cacao*, a native of tropical America and extensively grown in the West India Islands, Brazil, Guiana and Central America generally. In common with coffee, the cocoa seeds before exportation are sun or artificially dried, and then allowed to develop under suitable conditions of moisture and temperature a spontaneous fermentative action during which the nibs change colour, and lose the bitter, unpleasant and fatty flavour which characterises the raw beans, while flavouring and aromatic principles are developed.

The beans are again dried and are then ready for roasting or cooking. This operation is carried out either by direct heat or by means of superheated high-pressure steam. The beans are then cracked by roller action, and the husks and other extraneous matter removed by winnowing and subsequent sifting, the released seeds forming the cocoa nibs of commerce.

The following is an analysis of raw Trinidad Cocoa nibs (Bell) :—

	per cent.
Water	5.23
Fat	50.44
Starch	4.20
Proteins	13.26
Astringent Principles	6.71
Gum	2.17
Cellulose	6.40
Alkaloids	0.84
Cocoa Red	2.20
Ash	2.75
Indefinite insoluble matter not determined	5.80

The most notable feature of the figures is the high percentage of fat, giving the nib a very high caloric value, and a satisfactory percentage of protein. The carbohydrate content is small.

The astringent principle is not identical with tannin of tea and its nature is not well understood, but it resembles tannin in its general reactions in digestion. Part of this constituent is oxidised during the manufacturing processes into "Cocoa red." The alkaloids are theobromine and another allied to caffeine. Cocoa red gives the characteristic colour to cocoa and is not present in the freshly gathered bean. During the fermentative and roasting processes it is formed from the astringent principles, thus reducing the harsh character of the raw bean.

Pure Cocoa.

Cocoa nibs contain too much fat for use as a source of powder for the preparation of the beverage, and part of this is removed usually by hydraulic pressure. The nibs are subjected to heavy pressure between steel rollers and expressed as a pasty mass. Part of the fat is now removed by hydraulic pressure and the residue is run into moulds forming what is known as "flake cocoa" from which the various cocoa powders are prepared.

The composition of cocoa as sold to the

public differs considerably from cocoa nibs, as the following figures show :—

	Cocoa Nib (Average Analysis.) per cent.	Cocoa Powders sold to Public (Average Analysis.) per cent.
Moisture	5.30	4.0
Fat	50.44	28.0
Proteins	13.26	21.0
Non-Nitrogenous Matter other than Fat	28.25	41.0
Ash	2.75	6.0
	100.00	100.0

The notable points are the reduction in the fat, with a corresponding increase in all the other constituents.

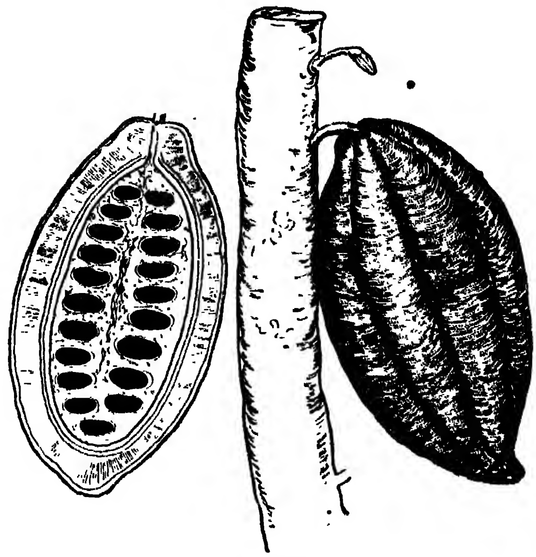
Cocoa is made with boiling water usually with the addition of milk, and though not miscible in water the grounds are usually stirred up and consumed, thus giving the full caloric value of the powder used. Cocoa in itself thus gives tissue-building principles in the form of protein, and energy and heat food in the form of fat. In addition, the alkaloids give a nervine stimulant analogous to those present in tea and coffee, and exerting a similar exhilaration of action.

Food Value.

The astringent principles in cocoa are apparently not so active as those in tea and coffee, and thus the beverage is more healthful than either. An ounce of cocoa on the above figures would give about 120 calories. Assuming that one-third of an ounce is used for a meal ration it would yield 40 calories. If made with, say, one-quarter of a pint of milk in addition to water, and one-eighth of an ounce of sugar, the total calories would be raised to about 160. Cocoa well deserves the designation of a "stimulating, grateful and comforting" food beverage with astringent action at a very low point.

The aroma of cocoa is not so pronounced and does not depend on volatile oils, as in the case of tea and coffee. It is a water-soluble substance capable of distillation, and is probably produced during the fermentative and roasting processes from one or more of the nitrogenous constituents of the raw bean.

The high percentage of fat renders cocoa



COCOA PODS
Showing how the rows of beans are arranged in the large pods.

unacceptable to many people, and in these cases some of the so-called prepared cocoas would be more suitable. Another disadvantage of cocoa is that even the best and most carefully prepared cocoas are not entirely soluble in water, "grounds" being usually found at the bottom of the cup. Often these are left as an unconsumed residue and thus part of the nutriment is lost. A little stirring now and again, however, overcomes this by keeping the sediment suspended to be consumed *pari passu* with the liquor.

In some cases the "flake cocoa" is mixed with sugar and starch (chiefly arrowroot or wheaten) and is then known as "Rock Cocoa." This addition reduces the proportion of fat and protein, and adds carbohydrate to the mixture, and some proprietary brands are compounded on this principle. The following is an average analysis :—

Prepared Cocoas.

	per cent.
Moisture	2.6
Fat	22.0
Added Starch	16.0
Added Sugar..	30.0
Protein	10.5
Other Non-Fatty Constituents	16.4
Ash	2.5
	100.0

Calories in 1 oz. = 130

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THE COCOA HARVEST

Workers picking cocoa pods in Ceylon. The seeds are extracted from these and are dried and fermented before becoming the cocoa " nibs " of commerce.

Compared with the pure cocoa powders this gives a slight increase of caloric value, and the carbohydrate content is greatly increased. The invigorating effects, however, are considerably reduced owing to the dilution of the alkaloid principles by the addition of the non-stimulating carbohydrate food bases. The popular taste for these cocoas is rapidly dying in favour of the pure product.

Soluble Cocoa.

Ordinary cocoa is not entirely soluble, being partly held in a fine state of suspension in the hot liquid with which it is made. Many cocoa manufacturers use alkali to aid the solubility, the action being partially to saponify and emulsify the fats and soften the fibre. Many Dutch cocoas are of this character. Probably the addition of alkali in the proportions generally used is not harmful, but it is doubtful whether the slight physical advantage gained justifies the addition of a chemical to a daily beverage. Cocoa lacks aroma and flavour, and most manufacturers add flavouring material to enhance the gustatory properties, the most used being vanilla.

How to make Cocoa.

The old-fashioned method of making cocoa in the cup does not develop the flavour, nor does it secure the best physical state of solubility and suspension. The following method is recommended :—

Mash the quantity of cocoa powder in a large cup with hot water to a smooth paste, gradually adding more water until a liquid state is reached. Pour this into a saucepan and add the remainder of the water. Bring to the boil and gently simmer for half a minute, constantly stirring, after which it is ready for serving. Should half milk be used in conjunction with water, bring the cocoa and water as before to the boiling point and simmer for half a minute, and then add the milk and bring up again to just short of simmering point. This method develops

flavour and aroma, and gives a very smooth beverage with very little sediment.

Cocoa may be regarded, especially if made with milk, as being very suitable for children, and it gives generally a beverage milder in its stimulating action than tea or coffee, with much less astringent action, if any, in the digestive processes. In addition, it gives a notable caloric and tissue-building value.

Chocolate is prepared much in the same way as cocoa and is often used to make a breakfast beverage. The cocoa from which it is prepared usually contains the full complement of fat, with added starch and white cane sugar. Various flavourings are added including vanilla, cinnamon, clove, according to the particular recipe of the individual manufacturer. Its food value is about equal to that of compounded cocoa given on page 1415.

FRUITS

THE IMPORTANCE OF FRUIT

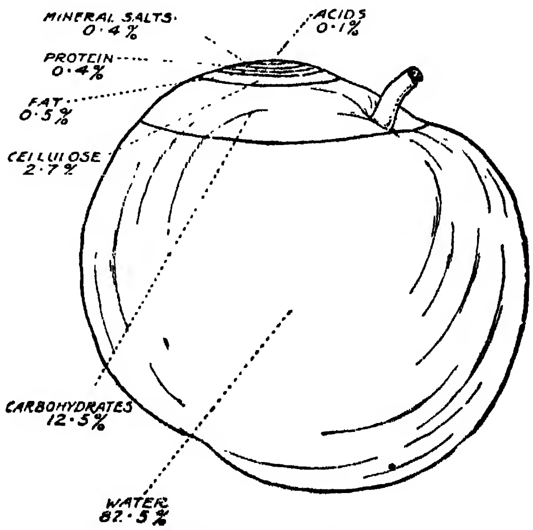
By SIR W. ARBUTHNOT LANE, Bart., C.B., M.S., F.R.C.S.

FRUIT forms one of the classes of "protective" foods; that is, we can ensure that we are obtaining sufficient of certain necessary food materials by eating it regularly. All kinds of fruit are not of the same value, of course. We must know something about the food properties of each to choose what we need.

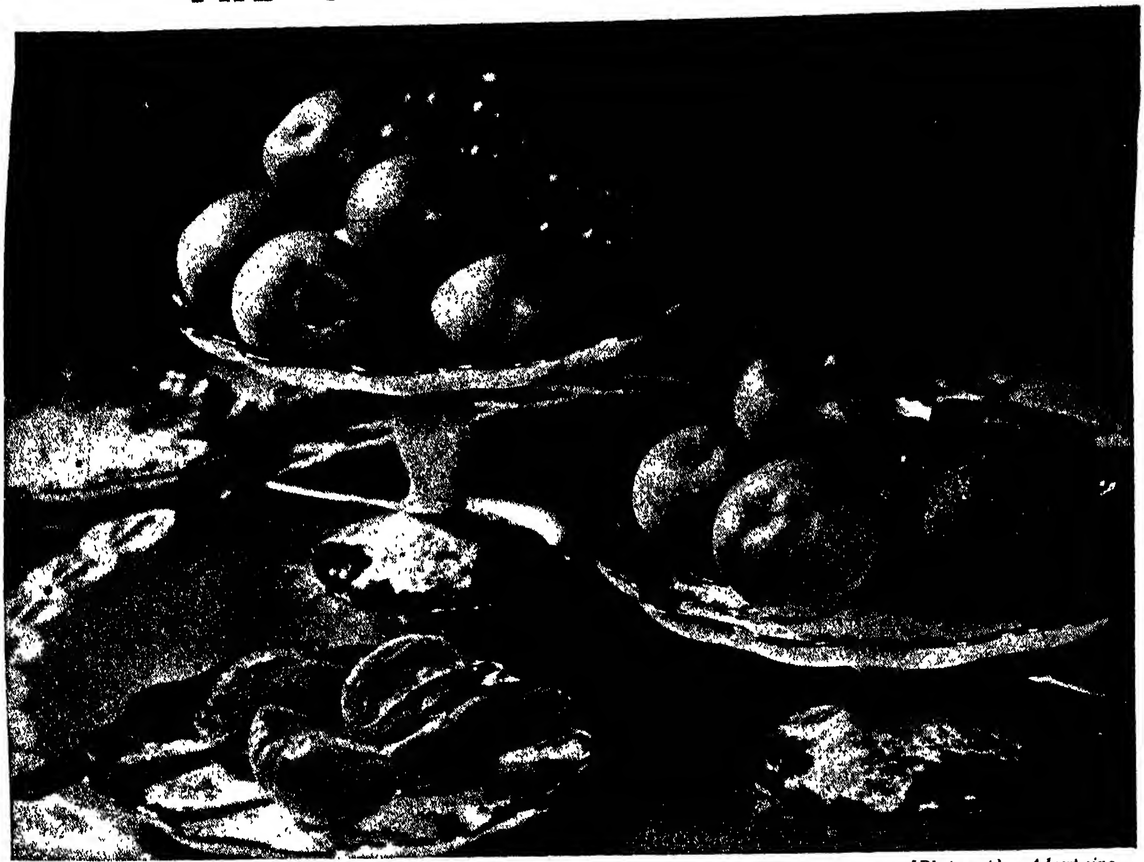
There are certain food factors, known as vitamins, of which we need a constant supply. For one of these, vitamin C, which is only found in fresh foods, fruit is our most convenient source of supply. Vegetables provide plenty of vitamin C, but only as raw salads; cooking soon destroys this vitamin, and unfortunately most of our vegetables are cooked. If we do not have sufficient vitamin C we begin to show the earliest symptoms of the disease scurvy, which sailors in the olden days, at sea with no fresh green food, found a terrible enemy. Fresh fruit every day, therefore, should be the rule.

Our bodies also need a regular amount of certain mineral salts, and in providing these fruit is equally important; for instance, calcium (lime) is present in oranges, prunes and figs, while iron is obtained from raisins, dates and prunes. The acids in fruit are very valuable, as they are burnt in the body during digestion, and eventually help to keep the blood alkaline, as it should be in a healthy person. The idea that fruit causes acidity of the blood is quite false. Fruit acids also serve an important purpose in cleaning the teeth from fragments of food which would cause decay; hence an orange, or better still, because it is hard, an apple, should be eaten after a meal. These acids cause the digestive saliva in the mouth to flow more abundantly.

Raw fruit serves another necessary food duty by giving us the "roughage" which our digestive canal needs. This is the indigestible framework of the plant cells, which by its bulk causes the bowel to move the food onward and prevents constipation. But if our fruit is to help us in this way, and give us vitamin C, we must not cook it, and, similarly, if the acids are to be of any use to our teeth, we must not put sugar on it.



THE COMPOSITION OF THE APPLE
The apple also contains vitamins B and C.



[Photographic Advertising

THE IMPORTANCE OF FRUIT
Fresh fruit should be a regular item in the daily menu.

Vitamin C Fruits.

The best fruits for providing vitamin C are the orange, the lemon and the tomato. The orange is particularly valuable, as it contains also a certain amount of vitamins A and B, and minerals. Orange juice can be given to babies. The peel protects the fruit from dirt and germs. The tomato is a good source of vitamin B, and contains some of A, besides being very rich in C.

The apple is not such a good protection against scurvy, though two apples a day would be sufficient, as compared with one tomato, or half an orange. But the apple's advantage is that it is a hard food, which exercises and cleanses the teeth. Do not peel apples—clean them. The grape is of little use for vitamin C, but is rich in minerals and natural sugar, and is *laxative* (prevents constipation). "Grapefruit," which is now becoming so popular, is useful as providing vitamin C, and as an appetiser. Do not follow those foolish people who put sugar on it.

Fresh fruit in general is not a good or economical energy food for the human engine, though the banana is an exception. Besides being protected from dirt by its skin, the banana has a high value as a fuel food, and compares well with the potato. But dried fruits are far more useful in this respect. The date is the best, being a better energy provider than any other dried fruit, and very digestible. Dried fruits are also rich in the minerals and in natural sugar. Figs contain a good amount of energy food. They are also laxative; and prunes, too, are well known to be very useful in this way. Raisins and currants contain valuable minerals.

When we come to nuts, we find just those food properties which fresh fruit lacks. Nuts

The Value of Nuts. contain a good supply of protein; that is, material for supplying energy, for repairing the body and for growth. With cheese and cereals they can be used to reduce the amount of meat in the diet. They also form a valuable means of obtaining vitamin B, necessary for the proper working of the nervous system of the body. Nuts are very rich in minerals, and contain oils, though these do not provide vitamin A, found in various fats. Although nuts do not have an alkaline effect on the blood, they may well be included among the "protective" foods for the advantages already mentioned. By adding cream or butter, for vitamin A, to fresh fruit, dried fruit and nuts, we obtain a well-balanced meal.

Children should be encouraged to spend their "sweets" money on fruit. Natural sugar is better than manufactured, though there may not be so much of it; and no sweets can give the refreshing flavour of a juicy orange or crisp apple.

HEALTH VALUE OF CERTAIN FRUITS

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C., Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

THE ORANGE

From the earliest times oranges and lemons have been regarded as fruits of high value. To-day we are able to appraise them, not upon any hearsay evidence, but upon a sure foundation of established facts. In this article an attempt will be made to present a short summary of the chief virtues of these fruits, and to indicate the evidence of an experimental character to which we are indebted for this knowledge.

Orange juice has been more thoroughly studied than any of the other Citrus fruits.

A Natural Medicine. While they are all similar in their general properties, the orange easily ranks first as a food. It enjoys this reputation principally because of five factors—its richness in the anti-scorbutic factor and the presence of vitamins A and B, its valuable reserve of basic minerals, its energy value by reason of its sugars, its natural organic acids, and its palatability.

Conventional analysis shows that Citrus fruits are comparable in chemical make-up with the leafy vegetables and edible roots. They all contain much water, varying amounts of fruit sugars, but very little protein or fat. It is noteworthy that orange juice is the richest in sugar (10 per cent.) of the Citrus fruits. For the most part, Citrus fruits are more palatable than vegetables and roots. In the body they exert many beneficial actions. They are readily digestible. This is due probably to the vegetable acids, which are well adapted to assist digestion by increasing the flow of saliva and, indirectly, of the gastric juice, and of stimulating the action of the pancreas and liver.

They promote easy elimination. As diuretics, as Professor McCollum has pointed out, the Citrus fruits enjoy a popular reputation, but their action in assisting the movement of food along the alimentary canal without irritation is just as important. When constipation is being increasingly indicated as a pre-disposing cause of many of the so-called diseases of civilisation, these facts acquire a new significance.

The traditional reputation of the orange as an anti-scorbutic has tended to obscure its other valuable constituents. For instance, less than a decade ago the presence of vitamins other than vitamin C was apparently unsuspected. As a result of the researches of Osborne and Mendel in America, it has been clearly demonstrated that all three vitamins, A, B and C, are present in appreciable amounts in fresh orange juice. This discovery has been amply confirmed both in Europe and America by other workers, while recently the author showed that the content of these hitherto unsuspected vitamins is rather more than was surmised from Osborne and Mendel's earlier work.

It is also of importance that orange juice can now be concentrated to a small bulk so as to be preserved in its own fruit sugar. Such

[*Keystone*

GRAPEFRUIT
Showing how the fruit hangs in bunches like grapes.

concentrates, prepared under carefully controlled conditions, are as potent anti-scorbutics as the juice from which they were derived, while vitamins A and B appear to be conserved at the same time. Concentrated orange juice is continually finding wider applications in the manufacture of patent foods and in the preparation of summer drinks. It is also finding use in child welfare clinics, as an anti-scorbutic for armies, navies and expeditions, and in schools and colleges.

Growing Children.

In the author's investigation of orange juice, the anti-rachitic vitamin D was found to be absent. This result is of importance in the light of the excellent work of Chaney and Blunt in California. These authors, in a recent investigation on the effects of adding orange juice to the diet of growing children, found an increased retention of calcium, a more marked retention of phosphorus, and an increase in magnesium and in nitrogen. The weight of the children was also found to have increased considerably. In view of the absence of vitamin D from orange juice, it would seem that the marked retention of these bone-forming minerals is due probably to the alkaline nature of the ash of the juice which persists after combustion in the body.

Orange juice has been administered with benefit in various forms of infantile malnutrition, in rickets, acidosis, influenza, and in the insulin treatment of diabetes. It may well be that its valuable, though little understood, efficacy in many situations is due largely to its unique combination of less appreciated constituents.

GRAPEFRUIT

The grapefruit (*Citrus decumana*), the largest of the fruits of the Citrus family, had its origin in China. It is known under a variety of names; for example, in the United States it is the pomelo, on the Continent pamplemousse, and in parts of the West Indies, the shaddock. In the latter case, the term shaddock is now used to designate the largest species of grapefruit, which are frequently larger than a football and can weigh anything from 10 to 14 lbs. It is usually supposed to have received its name from a certain Captain Shaddock, who is credited with having first introduced the fruit from China into the West Indies. But the commoner term, grapefruit, which has given occasion for some speculation, arises from the fact of the close similarity in appearance of grapefruit growing on the tree and clusters of grapes ripening on the vine. Indeed, a grove of grapefruit trees with their clusters of smooth yellow globes is a sight not readily forgotten.

Before the war the grapefruit was little known in this country, where it is still considered something of a luxury because of its generally high price. In spite of this and the fact of its tartness, which prevents it from becoming a serious rival to the orange, the consumption of grapefruit is steadily increasing in this country.

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WHERE THE ORANGES COME FROM

Above—An orange grove in the Northern Cape, South Africa. *Below*—Picking navel oranges in one of the younger groves, California.

Grapefruit grows readily in Florida, California, West Indies (of which Cuban grapefruit is most esteemed), Porto Rico and South Africa. The fruit travels well and, if not over-ripe, will keep for nearly two months in perfect condition.

Chemical analysis reveals a composition of the juice similar to that of the orange. It does not contain as much citric acid as the lemon, but its chief characteristic lies in its peculiar bitter taste, which renders it very acceptable to those who have acquired a taste for it. This bitter taste is due to the presence of a glucoside (compound of glucose with the bitter principle proper), called naringin, and it is found distributed throughout the different tissues of the plant, *i.e.*, in the stem, leaves, flowers, rind, and juice.

Many at first find the juice too sharp for the palate, but it is surprising how soon the "grapefruit" habit appears to be formed. For a long while the bitterness of grapefruit was erroneously attributed to the presence of quinine in the juice, of which it is suggestive, but this is not so. This supposition led to a free use of grapefruit as prophylactic against fevers.

An Appetiser.

The ash of the juice, like that of the orange, has also some beneficial effect in the body. In vitamin content its record is not so good, being deficient in all the vitamins except the anti-scorbutic factor, vitamin C. While it is a valuable source of this vitamin, it is less potent than the orange and the lemon.

But it is as an appetiser that the grapefruit is chiefly valued, and in America it has come to be regarded as an excellent addition to the breakfast table. In this capacity it has undoubted merit, while, in addition, it has a cleansing effect in the work of the body. For reasons such as these grapefruit has of late figured largely in the menu of athletes in training, and it seems also by now to have established itself in the menu at dinner.

With the increasing demand and the improvement in shipping facilities, it is satisfactory to note the downward trend in price of this health-giving fruit. When it has reached a level within the scope of the small wage-earner the position will be still more satisfactory.

THE BANANA

Undoubtedly the banana is one of the most nourishing food fruits, and, together with the plantain, it occupies practically the same position in tropical countries, where it flourishes, as do cereals and potatoes in the temperate zones. Both are plants of great antiquity, and wherever they have been grown they have been used as a staple article of the food supply. In illustration of their remarkable productivity, the statement is often made that an acre of land planted with bananas will produce more actual food than the same area planted with potatoes or wheat. Thus it is said Humboldt calculated "that 100 square yards set with bananas would produce 4000 lbs. of fruit; the same area set with potatoes would produce 1000 lbs. of tubers, and with wheat only 30 lbs."

Although authorities are agreed as to the food value and fruitfulness of the banana, there is little unanimity of opinion as to the origin and spread of this wonderful food plant.

According to De Candolle there is only one banana (*Musa sapientum*), a native of Southern Asia, which was carried by Europeans to America. He considered the banana to have been first a native of the Malay Archipelago. On the other hand, the original home of the banana is believed by many to have been in India, at the foot of the Himalayas. It is certain that when Alexander the Great invaded India, he found large tracts of land in the lower valley of the Indus devoted to its cultivation. In fact, the name itself, *Musa sapientum*—the fruit of knowledge—arises from the belief that the ancient sages of India reposed in the shade of the banana tree and refreshed themselves with its fruit. Although the banana was known to the Greeks, Latins and Arabs, it was apparently unknown to the ancient Egyptians and Hebrews.

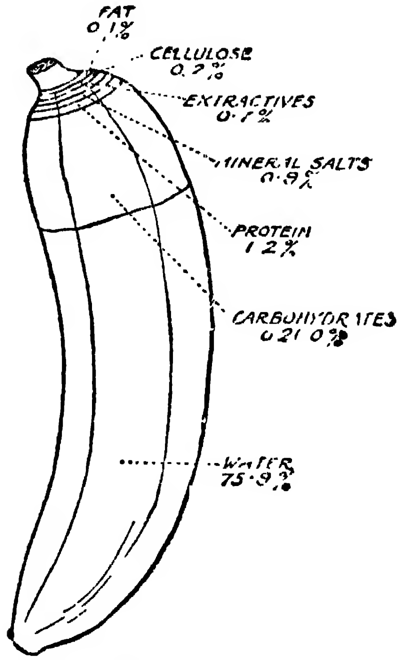
Rival claims of origin are made by the explorer, Humboldt, for America. Its origin in the New World is very obscure, but it is

perhaps significant that certain writers include the banana amongst the chief items of the food supply of the ancient Incas and Aztecs of South America long before the arrival of the Spaniards. In any case, it is remarkable that in each of the languages native to the regions where the banana appears, this plant, in common with many others, bears a special name not proceeding from the conquerors.

There are many species of the banana plant, or tree, as it is usually known, the most important from the economic point of view being *Musa sapientum*, grown principally around the Caribbean Sea; *Musa Cavendishii* (Cavendish or dwarf variety), found in the Canary Islands and the African mainland; and *Musa paradisiaca*, commonly known as the plantain, and found in all the banana-growing districts. The latter species is supposed to derive its name from the legend that the plant flourished in the Garden of Eden.

It will be useful to consider briefly the culture of this important fruit. Bananas are grown to the best advantage in a tropical climate with a heavy rainfall; but in certain areas where the rainfall is low, and where also the soil is suitable, irrigation may be successfully practised. Hence, in Central and South America, one finds the fruit produced in great abundance, as also in the West Indies, tropical Africa, Asia and Australia. The fruit is also grown in the Canary Islands and in the Malay Archipelago.

Along the Atlantic coast of Central America, which offers ideal conditions for banana cultivation, are to be found some of the greatest fruit farms of the world. Here the banana tree can reach a height of even 40 feet, while the bunches of fruit can weigh 100 lbs. or more. The tree is an herbaceous perennial, and is perhaps the largest terrestrial plant not having a woody stem above ground. When full-grown it has a graceful palm-like appearance. The main stem of the tree is underground, being a thick, fleshy rhizome on which buds or "eyes" develop, much after the fashion of a potato.



THE COMPOSITION OF THE BANANA

Bananas also contain small amounts of vitamins A, C and E.

The subsequent progress of events in the production of a bunch of bananas is well described by Reynolds in his "The Story of the Banana":—

The Banana Fruit.

"As the individual plant approaches maturity, it produces a flower-bud, which later becomes a bunch of bananas. The stem which is to bear the fruit pushes up from the rhizome through the centre of the leaf-sheaths, until at the end of the ninth or tenth month after planting, the flower-bud emerges at the top of the trunk. As this flower-bud increases in size, it bends over and downward, looking not unlike a huge ear of corn enveloped in its husk. The bracts then drop off, disclosing the young bananas, quite small and pointing outward; these turn upward as they become larger. The terminal flower-bud on the cluster is sterile."

The banana is always cut from the tree in the green state, whether for local consumption or for export. For exportation, the fruit is, of course, cut earlier than when it is intended for local use, but the proper time

Courtesy] [*Elders & Fyffes*

HARVESTING THE BANANA

The banana grows best in damp, tropical countries, and the fruit is always gathered while green and allowed to ripen off the tree.

for cutting is well known to the experienced planter. It is a curious fact that if allowed to ripen on the tree, the delicious flavour is lost and the fruit is rendered insipid; the skin bursts and the soft pulp becomes a ready prey for insects. The fact that the banana will ripen satisfactorily after it has been removed from the tree has naturally led to its extensive commercial exploitation in the markets of Europe, especially in the densely populated areas. Indeed, the history of the banana trade, which is closely associated with the name of the late Sir Alfred Jones, is in itself one of the romances of modern business. Starting from very small beginnings only a generation ago, it has developed into a food industry of great importance. This industry involves a specialised system of production, a network of plantation railways for transport, a private wireless service, and specially constructed refrigerator ships.

Because of its food value and delicious flavour the banana is perhaps the most useful of the raw fruits. It is of high energy value, higher than that of many other fruits and vegetables.

Importance of Ripeness.

The luscious pulp of the ripe fruit is enclosed in a germ-proof, glove-like, skin, which is a guard against all contamination. Both the flavour and the food value, it should be remembered, depend upon the state of ripeness. When eaten in the unripe condition, *i.e.*, before the starch grains have been converted into sugar, the banana is likely to cause digestive trouble. If the green fruit is used, it should be boiled or cooked like a vegetable. From the green, unripe fruit banana flour is made by drying and then reducing the starchy material to a fine powder.

The fruit is not properly ripe for eating until all traces of green have disappeared and the golden peel is flecked with specks of brown. It is then not only a delicious and nourishing fruit, but one that is readily digested by almost any one. Dried bananas

are also appearing on the European markets in increasing numbers. They are usually prepared by exposing the ripe fruit to the sun, and when they commence to shrivel, the skin is removed and they are then dried completely. The dried fruit, which is white and mealy with an outer coating of sugar, is then pressed into masses. They are of a sweet nature, something between that of a date and a fig.

CHEMICAL COMPOSITION OF THE BANANA COMPARED WITH THAT OF SOME OTHER NATURAL PRODUCTS

	Per Cent. Water	Protein	Fat	Carbohydrates	Ash	Authority
Banana ..	75.3	1.3	0.6	22.0	0.8	Atwater
Potato ..	78.3	2.2	0.1	18.4	1.0	Atwater
Banana Flour	11.1	3.55	0.83	81.7	2.23	Tibbles
Orange ..	86.9	0.8	0.2	11.6	0.5	Atwater
Apple ..	84.6	0.4	0.5	14.2	0.3	Atwater
Wheat Flour	14.0	11.4	1.0	75.0	1.7	Tibbles
Oatmeal ..	8.9	15.5	10.1	54.8	4.0	Tibbles

Food Value. The analytical figures for the chemical composition of the edible portion of the banana show that it consists chiefly of carbohydrates and that it is deficient in protein and fat, as in the above table.

It will be seen from this table that in chemical composition the banana compares favourably with the potato, for example, but has the advantage over it that no cooking is required. The carbohydrates in ripe bananas are principally composed of sugars and average about 20 per cent. of the edible portion. Reference to the table also shows that the banana is appreciably richer in energy-producing material than either the orange or the apple. A comparison between banana flour, wheat flour and oatmeal, as Tibbles points out, is to the disadvantage of the fruit and shows it to be deficient in protein and fat, though richer in carbohydrates.

As a source of the vitamins the banana is disappointing, since experiment has shown it to contain only very small amounts of vitamins A and C. As regards minerals, the fruit is rich in potassium salts and contains also small amounts of calcium, magnesium and phosphorus.

The flavour of the banana blends well with that of other foods, so that it can be used in preparing all kinds of dishes. It can be eaten raw (when ripe), fried, or with milk, cream or ice cream, as well as with other fruits. Bananas and cream form a very tempting dessert, and one in which the protein and fat deficiencies of the fruit are compensated by the presence of these essential factors in the cream. The banana is obtainable all the year round, and, of still more importance to the average housewife, it is a fairly cheap fruit in this country. With the increasing

[Photographic Advertising

FINE FLAVOUR—AND GOOD FOOD!
A much travelled fruit begins its last journey.

demand both in Europe and America, it will be gratifying to see this valuable food-fruit become yet cheaper and consumed correspondingly by our dense populations.

THE FIG

The fig has been esteemed from time immemorial, and, with the olive and the grape, is the fruit most frequently mentioned in sacred writings of the Hebrews and the Egyptians. It has mention also in the works of several Greek writers—for example, in the "Iliad" and the "Odyssey." The origin of the fig, and its distribution, bear a close similarity to those of the olive. It is found growing wild in Syria, and from here it has spread westward along the shores of the Mediterranean Sea, and east to Persia and Afghanistan.

Thus the tree grows well in the semi-tropics, and two crops of figs are gathered each season—one in the early summer from pods of the preceding year, and a second larger crop in the autumn from pods of the spring growth. A fig tree in good condition can yield from 150 to 200 lbs. of fruit per annum.

Under the Greeks, the cultivated fruit was greatly improved, so that Attic figs became famous. From thence the cultivation of the fig spread westwards, and it seems likely that the fruit was growing in these islands at the time of William the Conqueror. To-day the chief supplies come from Asia Minor, Spain and Portugal, the South of France, and from California and Arizona in the United States. It is interesting to notice that at home a small supply is available from the fig orchards of Worthing.

Of the many varieties of fig, the common fig (*Ficus carica*), a native of Persia, is easily the best known. The choicest figs, known as elemé figs, which are soft and thin-skinned, are grown in the neighbourhood of Smyrna, which forms part of the ancient province of Caria, from which the botanical name is derived. The fruit is borne on a small bush-like tree, in the axil of the leaves of the female tree.

The ease with which the fig can be dried and thus satisfactorily preserved as a staple food, has been a factor of historical importance; for since the dawn of history, the dried fruit has been extensively used by wandering tribes and invading armies.

As in the case of the date, the male and female flowers of the fig are found upon separate trees, and the mode of fertilisation, known as *caprification*, is one of great interest. Only the female tree, which bears the fruit is cultivated, while the male tree, which bears the *caprifigs* containing the male flowers, grows wild.

It was known from ancient experience that if the mature figs were to be of the desired size and flavour, it was essential that they should be fertilised by the male flowers of the caprifigs. This is actually brought about by the agency of the fig wasp, whose eggs are found in great numbers on the caprifigs. The female insect, when she has escaped from the staminate or male flowers, is covered with pollen. Instinctively she searches for a place in which to lay her eggs, and finding the figs, as it were, conveniently to hand, she forces her way into the closed flower-bearing receptacle, thus pollinating the female flowers. In fig cultivation it is of course essential to have sufficient caprifigs growing adjacent to the cultivated trees to supply the necessary pollen.

Although figs are eaten in the green, fresh state, for exportation they are usually dried

Preserving Figs.

by one of three methods—namely, sun-drying, sulphur-drying, or lye-drying.

SUN-DRYING.—The best figs (Turkish elemé) are simply dried in the sun, the exposure varying somewhat, but lasting about ten days. The moisture is thus driven off, while some of the sugar, which crystallises on the surface of the fruit, acts as a preservative. The dried figs are then graded, pressed flat, and packed in wooden boxes. The packing of figs for export requires much skill and experience, some being packed in barrels or bags, some in strings or mats, others, again, in esparto baskets or "tapnets."

SULPHUR-DRYING.—In order to destroy spores, and the larvae of insects, in certain

[Keysto

FRUIT DRYING IN THE SUN

Though most fruits can be sun-dried, figs and dates are eaten far more largely in this condition than when fresh.

districts around the Mediterranean Sea, the figs are first exposed to the fumes of burning sulphur. After this treatment they are sun-dried as before until they have lost about two-thirds of their weight.

LYE-DRYING.—In other fig-growing regions sterilisation is carried out by immersing the fruit for one or two minutes in boiling lye (potash). The alkali is afterwards removed by washing in water, when the figs are finally dried in the sun or in ovens.

In addition to figs preserved by any of the above methods, within recent years canned figs have been placed on the market.

Figs are a useful fruit to the housewife; they can be made into an excellent pudding, or stewed—a staple dish in the countries where they are grown.

Food Value.

Analysis shows that figs on the average contain about 18.8 per cent. water, 4.3 per cent. protein, 0.3 per cent. fat, 74.2 per cent. carbohydrates, and 2.4 per cent. ash. They are therefore chiefly composed of the carbohydrates, and as such are a good energy-producing food, a pound of figs producing about 1475 calories. Most of the carbohydrates are in the form of sugars (glucose and fructose), so that they are readily assimilated. However, in common with the banana and the date, analysis shows the fig to be deficient in protein and fat, but this deficiency may be remedied by the addition of milk and cheese to the diet.

Whether fresh or dried, figs are a wholesome and desirable fruit. Dried figs are sustaining because of their high sugar

content. They are pectoral and laxative, but if eaten to excess they may cause flatulence and diarrhœa. The ash of figs contains small amounts of potassium, sodium, calcium, and phosphorus, the potassium salts being most abundant.

The syrup obtained from dried figs is said to contain a number of enzymes useful to the body. The vitamin content of dried figs is negligible.

DATES

FROM the earliest times the fruit of the date palm has been a staple food for the inhabitants of the hot lands where it thrives.

[Topical

A CLUSTER OF DATES

The nutritive qualities of the date and its easy cultivation render it a favourite fruit in eastern countries.

Before the Christian era it was found flourishing in the region between the Euphrates and the Nile, and to-day its cultivation is still the chief industry in those areas. It has frequent mention in scripture, Jericho, for example, being the "City of Palm Trees," and Bethany, the "House of Dates." Because of its elegance and grace it became a favourite woman's name (Tamar) with the Jews.

The chief centres for date production are in Mesopotamia, Asia Minor, North Africa; but dates are now being cultivated in increasing quantities in the Empire, chiefly in India and Australia. Of these centres, the Persian Gulf area is easily the most important with its hundred million palm trees. In Mesopotamia the date palm forms the basis of taxation. Instead of being assessed on land and income the Arab is taxed on the number of date palms in his possession.

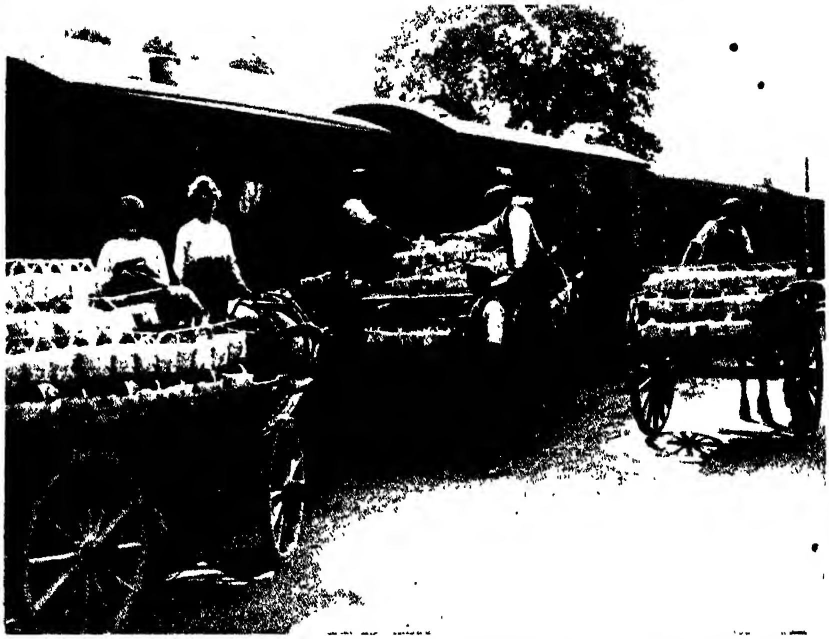
Date growing, requiring little labour, is naturally popular with the Arab. The trees are propagated chiefly from cuttings. Irrigation is practised in most of the date-growing regions, while the pruning of the palms, though often neglected, is essential for the maintenance of high yields. The climate is extremely hot, the temperature often remaining well above blood heat for many days and nights. In Africa and Mesopotamia dates usually ripen at the end of August, but not until December in Spain and Sicily. The date palm will live very often for 200 years, and will produce satisfactorily throughout that period. The soil is usually basic and the palm can tolerate more alkali than any other tree. Like the fig, male and female flowers are borne on different trees, and when in bloom the natives climb the pistillate trees and sprinkle their blossoms with pollen from the staminate trees. The fruit grows in bunches often weighing up to half a hundredweight.

The delicious honey-like flavour of the ripe date is unfortunately unknown in Europe,

Sun-dried Dates.

because only the dried product is exported. The dates when collected from the groves are dried in the sun, as in the preparation of raisins, ready

for transport to Europe and America. There is one disadvantage here which should be noted. Owing to their sticky character every chance exists of dirt and dust contaminating the product. During recent years something has been done to control this stage of the process, for there is no reason why the date should not be as clean and wholesome as the sultana and the raisin. However, as a precaution, dates should be washed before eating.



[From "Fruit Marketing" (Report No. 15), By permission of the Controller, H M. Stationery Office

LOADING STRAWBERRIES AT CHEDDAR
Strawberries from Somerset on their way to the London markets.

Dates differ widely from ordinary fruits because of their concentrated nature. They contain 68 per cent. carbohydrates, 1.4 per cent. protein, 0.2 per cent. fat, and an energy value of 265 calories per 100 grams, a higher energy value than any of the dried fruits. The carbohydrate is practically all in the form of sugar, so that the ripe date is easily assimilated. Iron and calcium are found in the ash. But as a source of the vitamins the date is negligible.

It is thus not surprising that dates have been the staple energy provider for the Arabs and Kurds for centuries. It is often stated that ½ lb. of dates and ½ pint of milk is a sufficient meal for a person of sedentary habits. The Bedouin Arabs subsist on a diet of sour milk and dates, supplemented by dried fish and meat on the rare occasions when it can be obtained. On this dietary the Arabs have preserved their magnificent physique and splendid health.

Dates are put to many other uses. In the desert they are pounded and pressed into cakes to make "travellers' food." The cakes are soaked in water before use, providing at the same time meat and drink. From the sap of the date palm, the Hindus obtain "jaggery sugar," and palm wine which is made into an alcoholic liquor called "toddy.'

THE STRAWBERRY

Although the strawberry enjoys only brief season of barely two months in the height of summer, it is an established English favourite. The strawberry (*Fragaria*) belongs to the family of *Rosaceæ*, or rose family, and the "fruit" is a fleshy receptacle (*syconus*) which bears the true fruit (*achenes*) upon its surface.

Probably the name "strawberry" is due to the habit of the fruiting plant; its berries are strewn upon the ground by their weight bending the thin flexible stalks. The plant itself is a dwarf perennial, and the number of varieties appears to be legion.

The common strawberry grows wild all over Great Britain, and in other countries as far north as Lapland, and as far south as Spain. There is no evidence that the Greeks and Romans were acquainted with strawberry culture, and its systematic cultivation did not start in England until the fifteenth century. At this time the strawberry was practically unknown in France. The plant

was then taken to the colonies and foreign countries, where it became naturalised to its new habitat.

The many varieties now grown in England so abundantly are the result of numerous crossings, for the strawberry is a remarkable example of the inherent power of variation possessed by the plant, and of the success of the cultivator in exploiting it.

The Hautbois was perhaps our earliest garden strawberry, and a corruption of the name—" hobby "—is still heard on occasion from the London street-vendors, as a general term for all varieties. Other varieties were then introduced into England from Virginia and Carolina (1629), and Chile. From these and other species the different garden strawberries of the present time have been obtained by crossings and cultivation, but many new strains soon degenerate and revert to the original type. There are now a vast number of strains differing in colour, shape, size and flavour.

Strawberry culture can be easily undertaken by the small allotment holder, and, in fact, many have had marked success in raising this delightful fruit. Some knowledge and care is essential, but there will not be much difficulty if care is taken to plant the variety of strawberry best suited for the soil of the locality where it is to be grown. The plant, curiously enough, benefits from having the soil around it well pressed down and hardened.

The strawberry plant can be propagated in three ways: by seed, side-shoots, or by runners. The last method is the one usually employed. The runners are planted in the autumn, or if the season gets too late, it is better to wait for the spring. The period of fruitfulness of the bed depends upon the variety and the cultivation, and may vary from two up to six years.

English strawberries have been found on analysis by Plimmer to contain 87.6 per cent.

Food Value.

water, 10.2 of reducing sugars, 0.1 fat, 0.7 protein, 0.9 fibre, and 0.5 ash, with an energy value of 207 calories per pound. The fibre and seeds may vary from 2 to 5 per cent. Malic acid is the chief acid present. Thus, apart from the fact of their being an acceptable fruit, strawberries supply a useful amount of energy food. They also contain an appreciable amount of the anti-scorbutic vitamin C.

Strawberries are apparently not easily canned, as they tend to become discoloured and to break up in the can. Even so, in recent years strawberries have been successfully tinned in America.

This typical flavour fruit is used fresh, for cooking, and for preserves. It blends well with other fruit juices, such as orange juice. However, certain individuals show a peculiar susceptibility in their reaction to strawberries (and to certain other foods, such as eggs and oatmeal). In such cases a rash breaks out on the skin, and the sufferer is said to have an idiosyncrasy against the disturbing food, which should be avoided.

The strawberry is readily digestible, and is valuable in feverish conditions; also to invalids and convalescents. It is cooling, laxative, and diuretic, and is considered to have good effects in gout and rheumatism. Altogether, the strawberry is a most valuable and health-giving fruit.

THE GRAPE

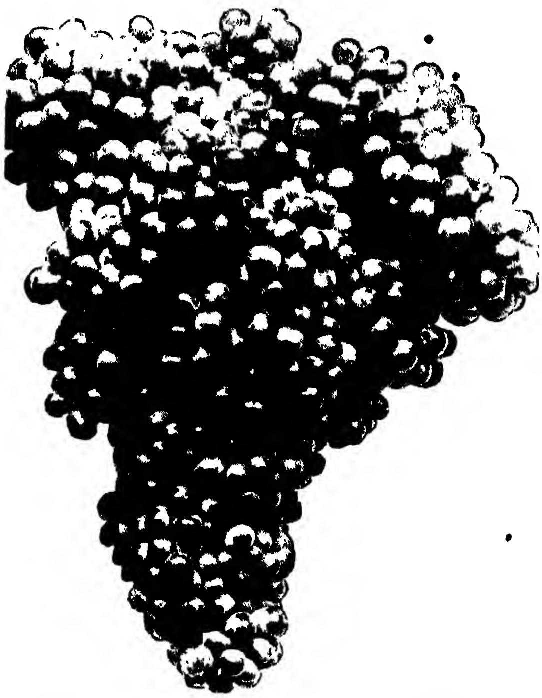
Throughout the temperate regions of the world, and in parts of the torrid zones, grapes are to be found growing wild. From these wild varieties the cultivated grape has been produced by centuries of careful husbandry, and is now to be found in all countries within the area bounded by 55° north latitude and 40° south latitude. It is, however, less common from the 21st degree to the equator on both north and south.

The vine is known to be of very great antiquity, seeds of the grape having been discovered in the lake dwellings of Switzerland. In Egypt authentic records of grape cultivation and wine-making go back five or six thousand years. The knowledge of grape culture was rapidly spread westwards by the Phœnicians, the Greeks and the Romans, but it is the Phœnicians who are credited with introducing it into Europe. In the East the progress of the vine was tardier, and it is

recorded by De Candolle that the Chinese did not possess it until 122 B.C.

Grapes are cultivated chiefly for five main purposes, namely, for eating fresh, for making all kinds of raisins by drying, for the production of many varieties of wine, for brandy, and for making unfermented grape juice. Grapes grown in the open in the northern part of the zone tend to be sour, while those grown in the southern area are more suitable for the making of raisins.

In the middle of the grape zone, where the finest fruit is grown, are found the wine-producing countries of the world, notably France and the Rhine Valley. But much wine is produced in Spain, Portugal, the Canaries, the Azores, the Grecian Isles, North and South Africa, and Australia. It is of interest to learn that grape culture, introduced by the Romans, was once an outdoor industry in England, although apparently only an inferior wine was obtained. The English vineyard has now disappeared, and the hot-house has arisen in its place, the produce of which is of excellent quality and is greatly esteemed. The output from this source is comparatively small, and most of the grapes consumed in this country are imported from abroad. The fruit travels well if properly packed in granulated cork, or, still better, in redwood sawdust.



Courtesy] [*High Commissioner for Australia*

A BUNCH OF AUSTRALIAN GRAPES

In the United States the early colonising attempts at grape cultivation underwent some vicissitudes. The first efforts failed repeatedly, the reason being that the foreign stock was exposed to a local pest, phylloxera, and to various mildews to which it was highly susceptible. These difficulties were eventually overcome when the foreign stock was crossed with hardier native varieties.

The quality of grapes, and hence the bouquet of wines derived from them, is greatly influenced by such factors as soil, location, climate, temperature, etc., and because of this the same variety grown in two different places may have quite different qualities. European grapes have a higher total content of solids, and are generally regarded as superior for the purposes of wine-making and for raisins. This may well be due to the knowledge and experience of European cultivators in the proper maturing of their wines. On the other hand, it is claimed that American grapes make the most refreshing unfermented drink.

The vine is propagated by cuttings, which readily establish themselves. When old enough to bear fruit, the plant is carefully pruned, so that only a few shoots are allowed to bear. The vines are usually trained on to poles, but in Italy they are to be seen growing on trees specially trimmed for the purpose. Numerous varieties of grapes are in cultivation, and these have given rise to the many different wines used to-day, for example, red and white wine, port, champagne, claret, burgundy and sherry.

Food Value

The composition of grapes varies very widely. The sugar content, which is their chief constituent, can be as low as 10 per cent, in some varieties, and as high as 30 per cent. in others. The remaining constituents consist of small amounts of nitrogenous matter, organic acids

and salts, as well as the skin and seeds, as shown in the analysis :—

THE COMPOSITION OF GRAPES.

	Per Cent. Water	Protein	Fat	Carbo-hydrate	Ash	Caloric Value (per lb.)
Grapes (av.)	84.9	0.6	0.1	13.9	0.5	274
Grapes e.p. (av.)	77.4	1.3	1.6	19.2	0.5	—
Grape Juice (unfermented)	92.2	0.2	0.5	6.9	0.2	—

In taking averages for this table figures used for grapes bought in the English market are those of Plimmer, and for American grapes, those of Atwater. The sugars consist almost entirely of dextrose (grape sugar), with a little lævulose (fruit sugar), *i.e.*, sugars which can be directly absorbed without being broken down further.

Tartaric and malic acids are both present in the unripe grape, but as it ripens the malic acid disappears. From 0.5 to 1.2 per cent. of acids are present in ripe grapes. The tartaric acid is present chiefly as calcium tartrate and potassium acid tartrate. The remaining minerals are composed of small amounts of the phosphates, sulphates and chlorides of potassium, sodium, calcium and magnesia. The vitamin content of the grape is probably negligible for all practical purposes. In the raw state it contains a small amount of vitamin B, and a still smaller quantity of vitamin C.

Grapes are a delicious and nourishing fruit and, taken in suitable quantity, act as a stomachic, a mild laxative and a diuretic. Eaten raw they are an excellent thirst quencher. Like other carbohydrate foods, grapes act as protein sparers by saving the nitrogenous tissues and so reducing nitrogen excretion. But grapes must obviously be prohibited in such disorders as diabetes. In the "grape cure," so popular in Europe, from 2 to 8 lbs. of the fruit are eaten by the patient daily, the "cure" being continued up to six weeks. During the course of the treatment, however, it is essential that the remainder of the diet be carefully planned. The patients usually are made to pick the grapes themselves, which affords exercise and fresh air in a sunny climate. The treatment is advocated for the relief of a number of disorders, including dyspepsias, disorders of the gastro-intestinal tract, in wasting diseases, anæmia, etc. It should not be undertaken without expert medical guidance.

Grape Juice.

Unfermented grape juice makes an excellent fruit drink, acceptable alike to the abstainer and the non-abstainer. But until modern methods of sterilisation were evolved, it found comparatively little general use. At the time of vintage the skins of the grape harbour many spores of yeasts, fungi and bacteria, whereby alcoholic fermentation is immediately set up, once the raw juice is expressed. If an unfermented beverage is to be made, the fresh raw juice must be sterilised by some means.

There are two principal methods of carrying this out. The first method is by the use of chemical preservatives such as the organic acids benzoic and salicylic, and boric acid and sulphates. This method is obviously an undesirable one, because the preservatives, while being fatal to germ life, are also highly injurious to health. In view of the efficiency of the second method—heat sterilisation under pressure—the first appears to be no longer necessary.

By this treatment the sterilised grape juice appears to retain its natural flavour and its original chemical composition, so that the normal percentage of the different constituents present in the grape is to be found. Any vitamin C (anti-scorbutic factor) originally present would be destroyed, but this is no disadvantage, since grape juice should not be relied upon as a source of vitamins. Alcohol is absent. The drink therefore provides a valuable temperance beverage, either alone or with aerated waters.

By taking unfermented grape juice, those who desire can enjoy the advantages of the "grape cure" at home. The juice is used appropriately in various kidney and liver diseases, in acute nephritis and in affections of the gastro-intestinal tract. Its laxative properties render it of value in all constipated conditions, and its action in increasing the secretion of the bile is beneficial in certain disorders of the liver.

Courtesy] [S. African Rlys.

THE GRAPE HARVEST
Part of the day's yield in a South African vineyard.

THE FAMILY OF NUTS

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C.,
Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

COMPARED with fruits generally, nuts as a family are of much greater value to the food manufacturer because of their concentrated nature, their energy value being at least twenty times greater. Considerations of space in this article prohibit a detailed account of the nutritive value of each of the principal nuts; they will therefore be considered here as a class.

Because of their concentrated make-up, nuts have been popularly supposed to be difficult of digestion. The careful observations of Professor Jaffa on fruitarians in California, however, have shown quite definitely that nuts are not specially resistant to the digestive functions, and, if used in the diet with regard to their concentrated nature, constitute valuable human foods.

Four main factors are responsible for the important position nuts should occupy as food—namely, their high content of protein, great richness in oil, the presence of vitamin B, and their store of several of the minerals essential to life. The flesh-forming constituent, called protein, is usually about one-fifth of the weight of the edible portion in nuts. The chestnut appears to be the only notable exception; this, though poor in oil and protein, is unique in that half its weight is due to starch. In the analytical table, which gives typical analyses of some of the principal nuts, variations in chemical composition between different nuts can be seen at a glance. The figures refer to the edible portion of the nut in each case.

CHEMICAL COMPOSITION OF SOME NUTS

	Per Cent. Water	Protein	Fat	Carbohydrates	Cellulose	Ash
Sweet Almonds (Dried)	4.80	21.00	54.90	17.30	2.00	2.00
Brazil Nuts ..	5.28	18.00	66.07	3.78	4.22	2.65
Chestnuts (Fresh)	45.0	6.20	5.40	42.10	1.80	1.30
Coconut (Dried)	3.50	6.30	57.4	31.50	—	1.30
Hazelnuts (Dried)	3.7	14.9	66.4	9.7	3.2	1.8
Peanuts ..	9.20	25.80	38.60	24.40	2.50	2.00
Walnuts (Dried, European).	4.7	15.6	62.6	7.4	7.8	2.00

Actual feeding experiments have shown that the proteins of the almond, coconut, peanut, Brazil nut, filbert, and English walnut are of high biological value. In short, nuts provide what is known as "good" protein—that is, protein which can supply all the necessary bricks in right quantity required for the building material of a healthy body.

Nuts have long been valued for their oil, which usually comprises from half to two-thirds of their weight; their fuel value is consequently high. In view of their rich oil content the presence of fat-soluble vitamins might be expected. Unfortunately, experiment has not realised this anticipation, all the edible nuts tested having proved to be poor sources of vitamin A. Vitamin C, the anti-scorbutic factor, also appears to be absent. It is for their rich store of vitamin B that we must regard the family of nuts as of special value.

VEGETABLES

By JOHN CAMPBELL, Ph.D.

VEGETABLES play an important rôle in our dietary in supplying certain elements that are absent or deficient in cereal and animal foods. From the actual nutritive standpoint they occupy a low place in the scale of foods, but, nevertheless, they provide concomitants without which nutrition and metabolism would be incomplete.

In the first place vegetables contain inert and indigestible roughage in the form of cellulose and fibre which enables the bowels to propel the digesting food along towards the excretal orifice. In the absence of this ballast the muscular walls of the intestine have nothing to grip, and the peristalsis becomes weak, resulting in constipation with its attendant evils. The green cooking vegetables and salad forms are especially valuable in this direction.

Vegetables are also sources of vitamins which perform the essential function of linking up our food-stuffs with the actual nutrition of the cells and tissues. The green foods are especially anti-scorbutic. Most of the alkaline salts required by the body are supplied by the vegetable ration of our diet and this specially applies to salts of potash.

For example, the ash of the potato and parsnip contains about 50 per cent. of potash. These salts help to keep the alkalinity of the blood, lymph and urine at the normal percentage, and in this respect counteract simple acidosis.

The actual nutritive value in most cases is negligible. Fat is usually absent and the nitrogenous content is very low, consisting chiefly of amides and allied extractives, with only very small proportions of actual protein.

The actual caloric foods present are usually found in the form of starch and sugar, and some vegetables, *e.g.*, the potato, parsnip, carrot and beetroot, contain a notable percentage of these carbohydrates, giving them a considerable energy value.

One of the hopeful signs of health progress at the present day is the growing demand for vegetarian dishes—a demand which has led the cookery expert to invent many new methods of preparing and serving vegetables attractively.

Vegetables should as a matter of routine form a considerable part of our daily diet. They are blood purifiers and without the help of the inert ballast which they carry normal bowel function is debilitated.

COMPOSITION OF THE MORE COMMON VEGETABLES

	Water	Ash	Fibre	Protein	Carbohydrates	Fat	Caloric Value per lb.
Potato, Tuber	76.2	0.8	0.4	1.6	21.0	0.02	420
„ Skin	80.3	4.0	4.6	2.8	7.9	0.40	215
Parsnip ..	72.6	1.1	3.0	1.7	21.1	0.50	445
Carrot ..	89.4	0.7	0.9	0.9	11.2	0.10	169
Turnip ..	93.0	0.7	0.6	1.2	4.4	1.10	108
Beetroot ..	90.2	1.3	1.0	1.2	6.2	0.10	142
Cabbage ..	88.4	0.8	1.1	1.5	9.3	0.20	201
Spinach ..	92.8	1.8	0.5	1.8	2.9	0.20	95
Asparagus ..	90.8	0.9	0.9	3.1	4.25	0.50	138
Lettuce ..	95.4	0.8	0.6	1.1	1.90	0.20	64
Celery ..	93.7	1.0	0.8	0.6	3.80	0.10	86
Radish ..	93.6	0.8	1.1	1.0	1.4	0.1	86
Watercress ..	92.5	1.0	0.5	1.4	4.2	0.4	121
Cauliflower ..	90.2	0.9	0.9	1.9	5.9	0.2	153
Cucumber ..	96.7	0.4	0.2	0.6	2.0	—	51
Veg. Marrow	96.8	0.3	0.4	0.2	2.2	—	47

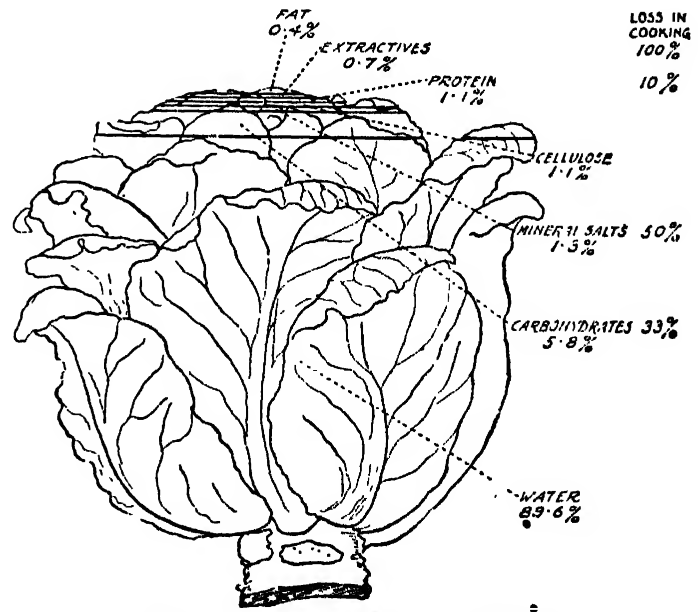
There is little need to stress the evils of constipation, for its dangers are now well known to all. The stagnation of the fæces in the lower bowel leads to bacteriological and other fermentations resulting in the formation of toxins which on being absorbed by the blood have poisonous effects on most organs of the body. Some of the repercussions one sees, for example, in the prevalent rheumatic and anæmic conditions which mark the present generation.

Improperly prepared and cooked vegetables lose many of their valuable properties. The general method of boiling results in a considerable loss of soluble constituents, which pass out into the water to be thrown away. Steaming is a better method, reducing the waste to a minimum. The common practice of adding soda to green vegetables in order to preserve the colour is to be condemned as its action is to destroy vitamin C.

Vegetables should be cooked in the minimum of time in order to preserve the precious vitamins. The method of using vegetables in stews, broths and casserole cooking is to be recommended, as by these methods none of the constituents are lost, and the flavouring properties are conserved.

The most valuable vegetables from the gustatory and vitaminic standpoint are the salad forms, which are eaten raw. These yield a delightful variety of flavours and involve a proper use of the masticating structures, and their vitalising constituents are presented in a fresh and active condition.

The Potato. Most people look upon the potato as merely a source of starch, but it contains vitamin C and a notable percentage of nitrogen in the form of amides. The most nutritious part of the potato is the layer which lies immediately beneath the skin, so that if it is deeply peeled the best part of the tuber is lost. New potatoes need no peeling, but should be simply washed and wiped. The soft skin is useful as roughage and the inner nutritious layer is preserved. Even old potatoes need not be peeled. They should be washed in warm water and scrubbed clean by a hard brush. This method will not remove the protein layer while removing the outer cork-like cuticle. The slogan "cook potatoes in their jackets" is not so very sound after all. If baked the skin and the inner adjacent layer become hard, and the attempt to scrape the skin clean is usually a failure. Scrubbing and then steaming in the



THE CONSTITUENTS OF CABBAGE
Cabbage is a reliable source of vitamins A, B and C.

Courtesy] [" *Good Housekeeping*

SOME USEFUL WINTER VEGETABLES

jacket is a much better plan, as in most cases the skin is soft enough to be eaten or can be cleanly peeled off on the plate.

Fried potatoes form the most nutritious presentation as they take up a certain proportion of fat, an element which is missing in the raw vegetable, but care must be exercised in the process to leave the chips or straws crisp. If allowed to become sodden and soft they are most indigestible. In mashing potatoes, fat, milk and flavouring condiments are usually added, and the dish then comprises a tasty and nutritious ration. Potatoes can well take the place of part of the daily bread ration and if served with butter and fish, or fat meat, or cheese, form a balanced meal.

Beetroot, Parsnips and Carrots are sources of sugar and help to make up the carbohydrate content of our daily diet. The expressed juice of young, raw, grated carrots is especially recommended as an aid to preserve the complexion.

Turnips and Swedes should only be used when young and fresh. The older roots become spongy and stringy, and are flavourless and indigestible. These vegetables are specially rich in anti-scorbutic vitamin C.

The Green Vegetables comprise cabbages of various kinds, Brussel sprouts, broccoli, turnip-tops, spring greens, spinach, etc. Their chief value lies in the roughage and salts they provide, spinach containing a notable percentage of iron.

The "Blanched" Vegetables include asparagus, sea kale and celery. Asparagus is esteemed chiefly on account of its distinct, somewhat bitter flavour, due to the presence of aspargin—a constituent that is also found in potatoes and lettuce, and other green vegetables. Celery, which may either be served raw or cooked, is one of the most salutary of vegetables. It is stimulating, relieves intestinal discomfort, is diuretic and is beneficial in rheumatic and allied conditions.

The Salad Vegetables like lettuce, radish, endive, watercress, and cucumber are eaten raw, and provide with appropriate dressing tasty adjuncts to meals in which cold viands form the principal part, also supplying roughage, vitamins and alkaline salts.

SPINACH

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C.,
Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

It is surprising that the value of spinach as food is not better known, and hence used to a greater extent by the housewife. Spinach

belongs to a genus of herbaceous plants of the family of *Chenopodiaceae*, and it is so ancient that its origin is lost in obscurity. We do know, however, that it was cultivated in the ancient empire of the Medes and the Persians, and was common in Babylon and Nineveh. In Europe, and especially in England, its cultivation has been of much more recent date (since the 15th century).

Two principal varieties have been grown; winter spinach, having small prickly leaves, and the smooth-leaved variety, having more fleshy leaves. New Zealand spinach, which is supposed to be hardier than ordinary spinach and is used as a substitute for it, is in every way inferior. It is also not a member of the true spinach family.

Fresh English spinach, like other green vegetables, contains about 92 per cent. water, 3 per cent. carbohydrates, less than 2 per cent. protein, and a little oil and ash. It has the special advantage over cabbage, for example, of having very little cellulose or fibre, and we shall see later the advantage of this in illness.

Vitamins and Minerals.

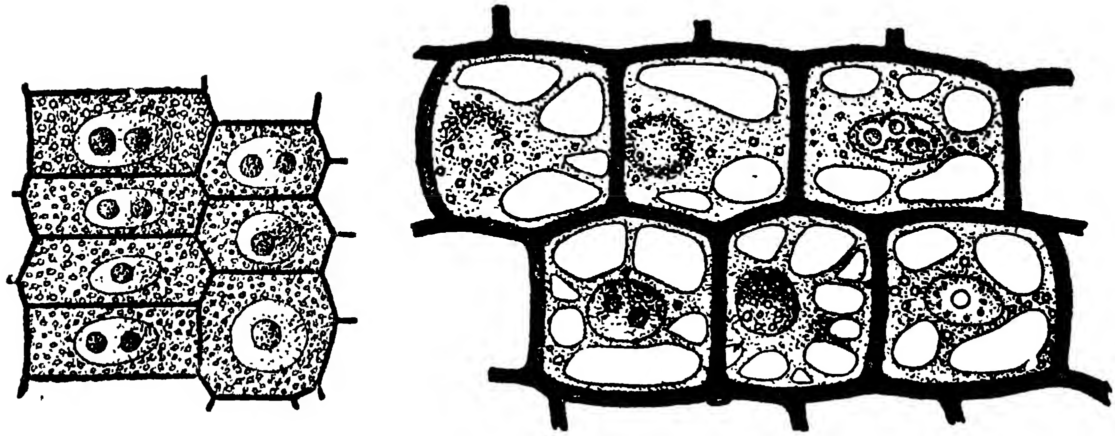
But it is not these constituents, valuable as they are, that enable spinach to claim a high place amongst green vegetables. Its claims can be based upon three factors: its high content of vitamins, the presence of minerals in considerable amount, and its marked aperient action in the body. Fresh spinach is a very rich source of vitamins A, B and C, while summer spinach may also contain a little of the bone-forming vitamin D. It is significant that dried spinach has been employed as the starting-off product in attempts to isolate vitamin A. In minerals, spinach is rich in iron, potassium, magnesium, and calcium; and is, in fact, a valuable means of introducing iron into the body. There is also a preponderance of the base-forming minerals in the ash of spinach. The laxative action of spinach was known to early native races, who used the vegetable regularly for this purpose. Even to-day it is known on the Continent as the "broom of the bowels."

Spinach, being a delicate vegetable, is

[D. McLeish

A BRETON ONION-SELLER IN LONDON STREETS

Though inferior in food value to the starchy roots, onions supply a small percentage of protein and carbohydrates as well as necessary mineral salts and roughage.



THE CELL STRUCTURE OF GREEN VEGETABLES
Left—Young cells with thin walls which are easy to digest. *Right*—Mature cells—the walls are strong and hard and more difficult to digest. (Highly magnified.)

usually well tolerated by the body, and is definitely more digestible than cabbage. It is soft and succulent, and has been used with success in chronic constipation, while because of the fact that it leaves little residue undigested in the intestine, it can often be taken when other vegetables are impossible. Thus, spinach is often used in diabetes, gout, anaemia, debility, and tuberculosis.

In the ordinary cooking processes, spinach loses most of its anti-scorbutic substance (vitamin C), but its content of vitamin A and vitamin B is not seriously reduced.

It is of interest that spinach is now becoming available in a somewhat novel form.

Dried Spinach. It has long been realised that for certain purposes the bulkiness of leafy vegetables is a disadvantage, especially when transport over distances is concerned. Unfortunately, we in England grow comparatively little of this valuable vegetable, although its culture is not difficult. But in North Africa, France and Australia, large amounts are available; and in the first-named region this has led the practical-minded Arab to sun-dry his spinach in the desert and to rub it down to powder for future use.

Such a product appears to be a highly satisfactory foodstuff which keeps well. In this form, or as spinach purée, a supply for making soups and many other dishes would be easily available to the housewife all the year round. This material would be devoid of the anti-scorbutic vitamin, but, on the other hand, might possibly contain some anti-rachitic substance by reason of its sun-drying. In any case, it is certain that a reliable supply of such a natural food product would be of the greatest value.

WATERCRESS

By S. G. WILLIMOTT, Ph.D., B.Sc., A.I.C., Government Analyst and Lecturer in Chemistry to the Government of Cyprus.

WATERCRESS (Nasturtium officinale) has long been regarded as one of the most valuable of the salads. It has always been a plant dear to the heart of the herbalist. Varieties of cress appear to have been used since antiquity, and it is recorded that cresses formed part of the diet of the Roman soldiers. The origin of watercress is obscure, but it seems probable that garden-cress came from Persia.

In England, cresses have earned their reputation by virtue of their efficacy as a cure for scurvy. For example, John Peachey in his "Compleat Herbal" (1694) prescribes all kinds of cress as being valuable anti-scorbutics. Dr. James Lind, writing in his admirable "Treatise on Survey" in 1755, also recommends growing cresses on layers of wet cotton as a practical means of preventing this disease.

Cresses are all members of the family of

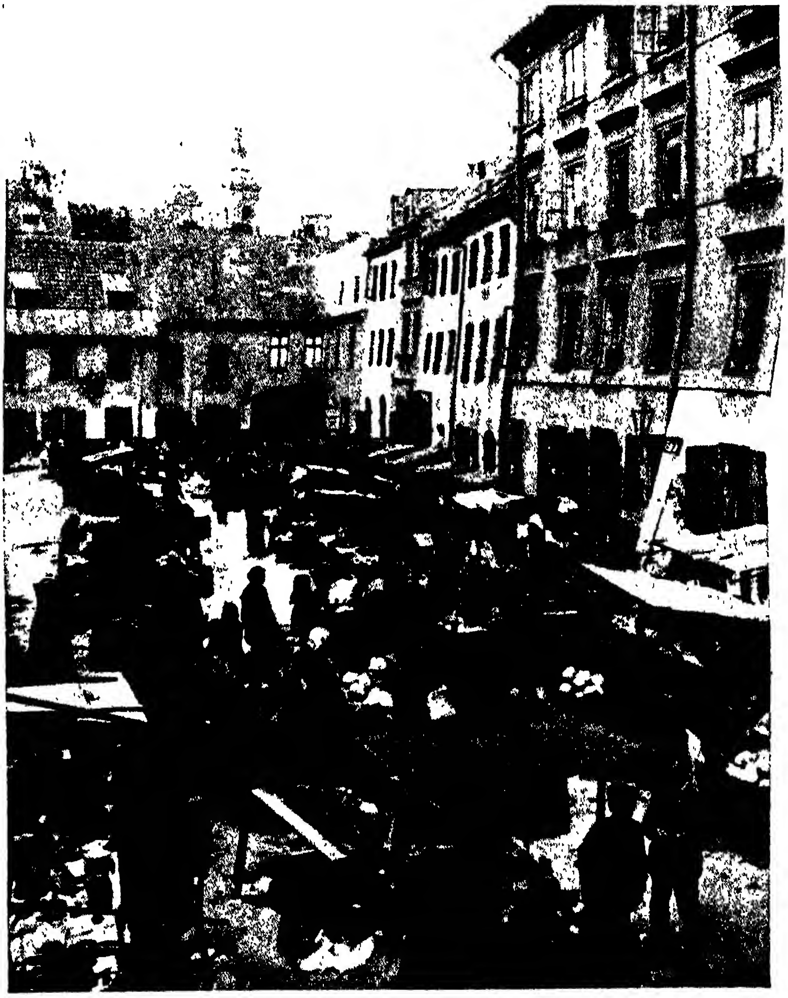
Crucifers. The two varieties most extensively cultivated are the bronze and the green leaved. The former variety is to be preferred because of the superior conditions of its cultivation. The bronze leaf variety is grown only in running water from natural springs or rivulets, whereas the green leaf is usually found in still water which is frequently stagnant. By present-day methods of cultivation, the beds of watercress are carefully protected from undesirable contamination so that no cress from stagnant water may reach the consumer.

The cultivation of watercress is an interesting though lengthy business that demands much care. The ideal ground is a loamy soil resting upon a gravelly subsoil, the loam providing good foothold and the gravel a firm bottom for cutting. Good watercress is also grown on sand or peat bottoms, but in this case cutting is rendered difficult. Watercress is a delicate plant, susceptible to extremes of heat and cold. With high water temperature, for example, the plants are apt to be small and to turn yellow.

Medicinal Value.

An extensive literature exists recording the many beneficial uses of watercress, both in health and in disease. In the old herbals it has always been held in high repute as a remedy for anaemic conditions; it was used extensively in the cure of "foul and filthy ulcers" with success. Quite recently watercress has been shown to have definite therapeutic value in all sorts of debilitated conditions, particularly in the relief of chronic constipation. For this reason alone watercress must be regarded as a most valuable agency in the prevention of this unnatural and dangerous condition.

In that other scourge of civilised life—cancer—this wonderful little plant is of direct service in the restraining influence it appears to have in the growth of cancers. Experiments initiated by Dr. Monckton Copeman on mice and rats showed that watercress does exert a peculiar ameliorative influence upon cancerous conditions. This of course does not mean that the plant is a cure for this terrible malady, but its preventive value seems to be established. Sir F. Gowland Hopkins made



[D. McLeish

A POLISH VEGETABLE MARKET

A view in the Jewish vegetable market in the Ghetto of Warsaw.

[J T Newman

A WINTER WATERCRESS BED

A watercress farm at Bourne End, Hertfordshire, where this valuable salad vegetable is grown in the winter in pure, "warm" water obtained by sinking wells deep in the chalk.

the interesting observation that this specific action could not be attributed to the vitamins known to be present in the plant. The question seems worthy of further study.

Centuries before the Christian era Xenophon had realised the dietetic importance of watercress, for it is recorded of him that he advised the Persians to feed their children on watercress if they desired to improve the physical health of their children. Human experience through many centuries, and the established facts of modern science, only serve to confirm the soundness of that ancient advice.

Food Constituents.

Watercress has a pleasant, pungent taste due to the aromatic oil it contains, and on this account it is popularly esteemed as a salad. Chemical analysis shows it to contain 93 per cent. of water, 4 per cent. carbohydrates, shall amounts of fat and protein, and a little ash. Calcium, magnesium, potassium, phosphorus and sulphur are present in very small amount, while some authorities report appreciable quantities of iodine also. Its reputation as a remedy for scurvy we now know to be due to its high content of vitamin C; smaller amounts of vitamins A and B are also present. Watercress is as beneficial to the lower animals as it is to man. Rats, mice and guinea-pigs eat it readily and thrive well, while its use by poultry farmers is found to lessen the mortality amongst incubated chicks and to favour the earlier development of pullets.

As a salad, watercress is superior to any other kind of cress. Indeed, the time seems ripe for its use on a larger scale than hitherto. It has the advantage over salads of being obtainable all the year round, and especially in the winter, when lettuce and other materials for salads are scarce and dear, its extended use is indicated. There is every reason to believe that a larger consumption of watercress could be sustained from home supplies.

[Lenare

IN THE KITCHEN—A HELPING HAND

XXII

FOOD AND THE HOME

THE PRESERVATION OF FOOD

HOME METHODS OF PRESERVING

By D. D. COTTINGTON TAYLOR, Director of the "Good Housekeeping" Institute.

IT is common knowledge that certain foods, such as meat, fish, milk, eggs, fruit and vegetables, decay or deteriorate rapidly if means are not taken to preserve them, whilst tea, sugar, macaroni, rice and biscuits remain wholesome for an almost indefinite period without any special efforts towards preservation.

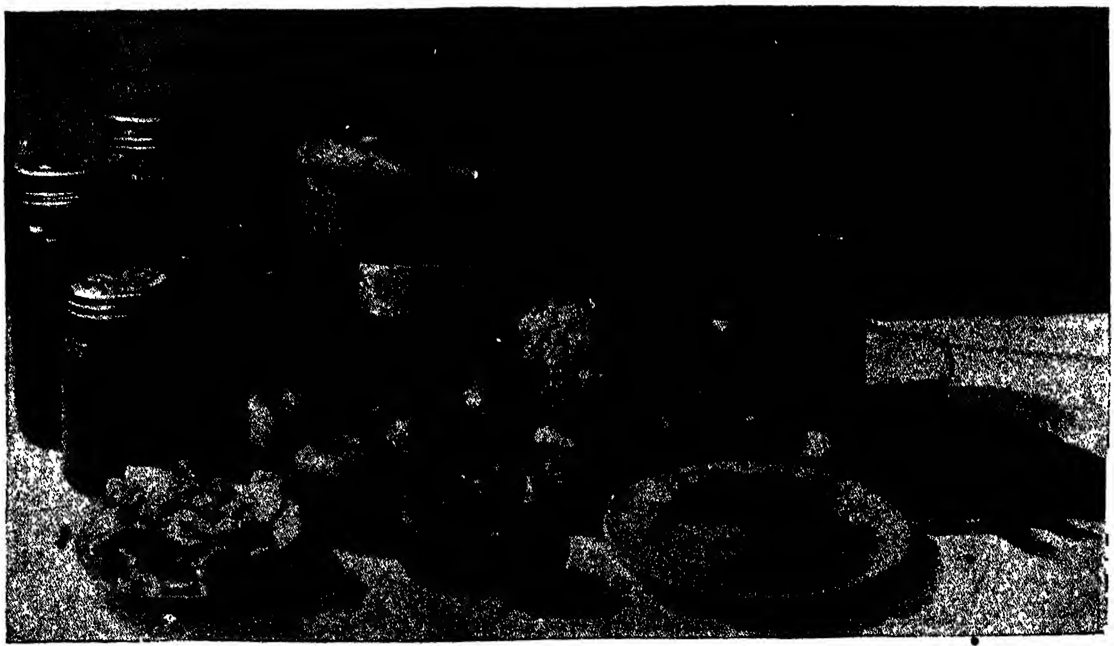
There is one great difference between these two classes of foods; the first contains a large percentage of moisture, and the latter very little, or an almost negligible amount. The presence of water alone is not sufficient to cause food spoilage—for fruit can be bottled in water satisfactorily—but it is a contributory cause. There is present in the air an enormous number of micro-organisms consisting of bacteria, yeasts and moulds, which attack food and bring about changes in its composition. Like all living things micro-organisms do not thrive unless conditions are favourable. They require food, moisture and warmth, but extremes of both heat and cold kill them or arrest their development. In order, therefore, to prevent food spoilage, special precautions have to be taken to make conditions impossible for bacterial life. The different methods include:—

(1) The application of heat—sterilisation.

(2) The extraction of moisture—drying.

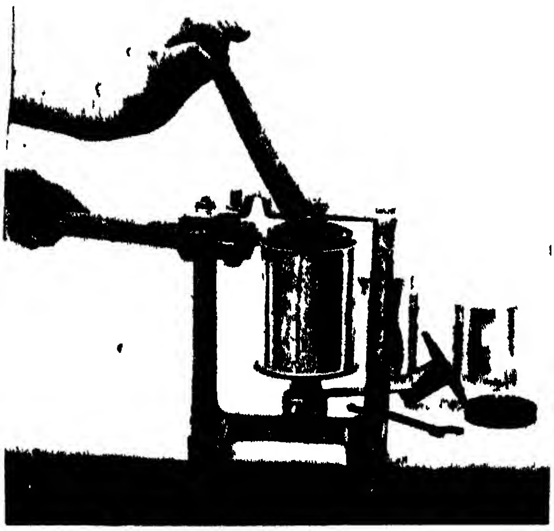
(3) The application of cold—freezing and chilling.

(4) The addition of harmless preservative substances, such as vinegar, salt, and sugar.



Courtesy] [*"Good Housekeeping"*

FRUIT AND VEGETABLES FOR PRESERVING



[From "Fruit Marketing" (Report No. 15), by permission of H.M. Stationery Office

A SIMPLE CAN-SEALER

A hand-power can-sealing machine for fruits and vegetables canned at home.

Bottling and Canning. Whether bottles or cans are used, the food is sterilised and special precautions are taken to prevent the entry of other micro-organisms. Until very recently canning involved the use of a soldering outfit, thus presenting difficulties to the average housewife. During the last year or so, however, a special "hand sealer" has been put on the market and perfected, with the aid of which it is possible to seal cans in a perfectly air-tight manner, with little effort. The University of Bristol Fruit and Vegetable Research Station at Chipping Camden gives an enthusiastic report as to the efficiency of this hand sealer.

One great advantage canning has over bottling is that less care is required, as there is no risk of breakage, and therefore the process can be carried through more quickly than bottling.

Home bottling demands no elaborate equipment, for ordinary jam jars, preferably of glass, and a fish kettle or clothes boiler are the only essential pieces of equipment, although it is hardly necessary to point out that special fruit bottles with screw lids and rubber bands have many advantages, and simplify the work considerably, whilst in households in which bottling is done regularly, steriliser would be invaluable.

In order that home bottling may be successful it is essential to remember that all living organisms, yeasts, moulds or bacteria, present in the fruit or liquid contained in the bottle, must be killed by raising the contents to a definite temperature and maintaining this temperature for a definite period. Having rendered the contents sterile, no fresh forms of life must gain access, therefore the bottles must be sealed without delay.

To bottle: -

(1) Wash and grade the fruit according to ripeness and size, and pack firmly into the bottles, using a silver spoon, piece of smooth wood, or bone spatula.

(2) Fill to within $\frac{3}{4}$ in of the top of each bottle with water or syrup according to taste. If syrup is preferred, make it by dissolving 1 lb. loaf sugar in 2 pints of water. Put the caps in position but do not screw down.

(3) Have ready a special steriliser, fish kettle, zinc bath, clothes boiler or other suitable container. Put the bottles into the boiler, protecting them from too great heat by standing on slats of wood or several thicknesses of brown paper.

(4) Fill with sufficient cold water to reach to the necks of the bottles.

(5) Commence to heat the water over a small gas jet or low fire, and bring the water slowly to 180° F. or simmering point, taking $1\frac{1}{2}$-$1\frac{3}{4}$ hours in doing so. Maintain this temperature for 10-25 minutes according to the kind of fruit being sterilised, *e.g.*, small soft fruit requires less time than large, unstoned plums. From the appearance of the fruit it is possible to tell when it is cooked.

(6) When the fruit is sterilised, remove the bottles from the boiler and screw down the caps tightly. If ordinary jam jars are used, pour on hot, melted, mutton fat and tie down with bladder or strong parchment paper.

An alternative method of bottling can be carried out in the oven. The fruit is packed tightly into the jars and put into a very slow oven to cook without any water. When it shows signs of shrivelling and looks cooked,

fill each bottle with boiling water or syrup and seal immediately.

The Bottling of Vegetables. The bottling of certain vegetables, particularly beans and peas which contain nitrogen, calls for special care, as they are more difficult to render sterile than fruit and non-nitrogenous vegetables, and risk of food poisoning occurs if imperfectly sterilised food is eaten. When possible a pressure cooker should be used, as peas require a temperature corresponding to 10-15 lbs. of pressure, but if such a cooker is not available the following method is advocated :—

(*a*) Wash and soak the pods in a weak solution of potassium permanganate. Shell and grade according to size. Tie the peas loosely in muslin bags and blanch by dipping them into a saucepan of boiling water for 2 minutes. Then plunge and leave them in cold running water for 10 minutes. Pack into bottles and cover with water containing 5 oz. lemon juice, 1 oz. sugar, and 2½ oz. salt, to 1 gallon of water. Proceed as for fruit bottling except that the water in the boiler must be brought to boiling point and boiled for one hour. On the following day unscrew and re-sterilise.

Drying. The methods of drying fruit and vegetables are not practised to any great extent by housewives in this country, but in hotter countries the heat of the sun is strong enough to evaporate sufficient moisture from fruit to preserve it.

CLEAN FOOD STORAGE
A sanitary container in which food can be kept free from dust and dirt.

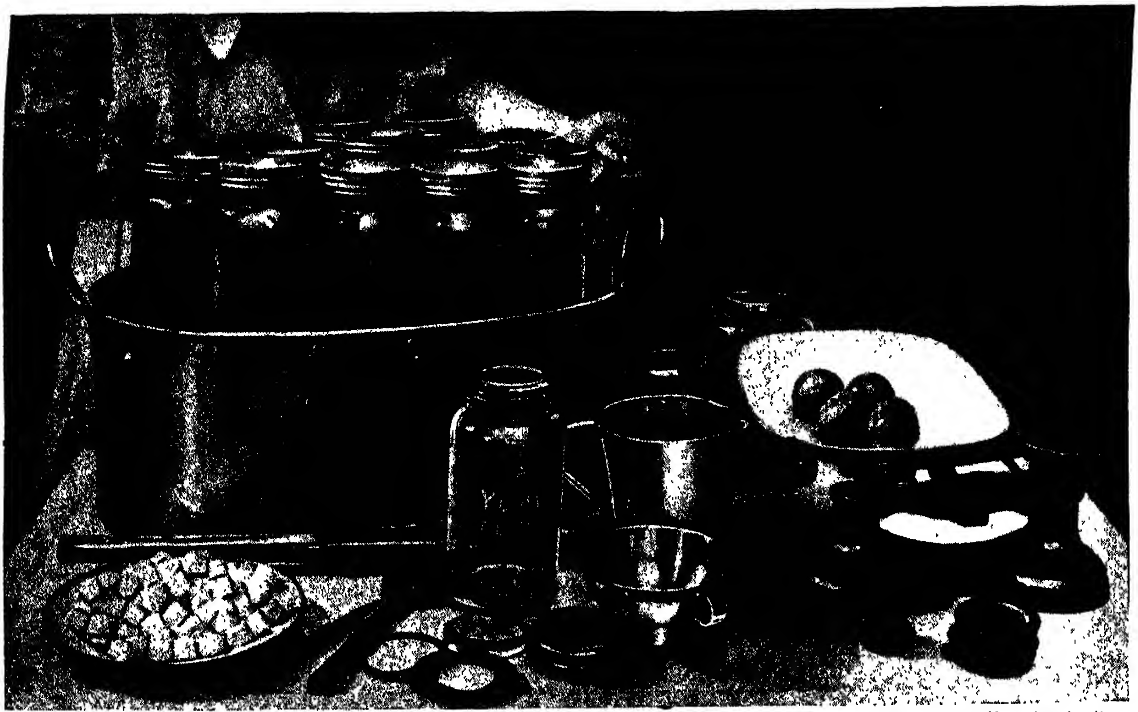
PRESERVING DRY FOODS
Hygienic glazed and enamel-ware for storing bread and flour.

Beans, peas, apple rings and herbs can, however, be dried satisfactorily in a cool oven. The requirements are very simple—a few wooden drying trays, stretched with muslin, and air-tight containers--boxes or tins in which to store the vegetables and apple rings when dry.

A temperature of 140°-180° F. is the best for drying, and when possible this should be determined by the aid of a thermometer as it is difficult to judge the correct heat by testing with the hand. The length of time required for drying depends on the amount of moisture contained in the fruit, but the process should not be hurried, and it is not necessary to complete it at one time. After drying, the contents of the trays should be left in the room uncovered for a few hours before being packed away.

The process of drying preserves food because sufficient moisture to maintain bacterial life is not allowed to remain. If, after drying, the food is allowed to become wet, moulds and yeasts will flourish and decay will occur.

Jam Making. In jam, the presence of a large amount of added sugar—at least 60 per cent.—is sufficient to prevent fermentation and mould growth. Sugar alone is not, however, sufficient to retard decay, the fruit must be rendered sterile by thorough boiling.



Courtesy] HOME PRESERVING [" Good Housekeeping "

The bottles of fruit are heated slowly in the preserving pan, allowed to simmer for 25 minutes, and are then lifted out on the perforated tray. The lids are screwed down at once.

The presence of vinegar, a form of acetic acid, acts as an antiseptic, whilst the action of boiling fruit or vegetables in vinegar with salt or sugar, renders them completely sterile and prevents further growth of bacteria.

Pickling.

SMOKING, SALTING AND STORING IN ALCOHOL are other means by which food can be kept in a wholesome condition.

As already mentioned all life requires warmth, and if any food is subjected to a very low temperature the moisture contained in it freezes and thus bacterial life cannot develop. Commercially, freezing and chilling are probably the most important means of preserving food, for enormous quantities of frozen meat are consumed daily. Refrigeration is, however, of interest to the housewife as a very useful and valuable means of preventing food spoilage. Household or domestic refrigeration differs widely from commercial refrigeration, for the object of the latter is to keep food wholesome for prolonged periods—months or even years if necessary—whilst the usefulness of a domestic refrigerator depends on its ability to maintain a fairly low temperature, generally between 30° and 45° F. This temperature is sufficiently low to retard the growth of bacteria, yeasts and moulds, and therefore both cooked and uncooked perishable food is kept in good condition for a much longer period if placed in an efficient refrigator than if stored at normal room temperature.

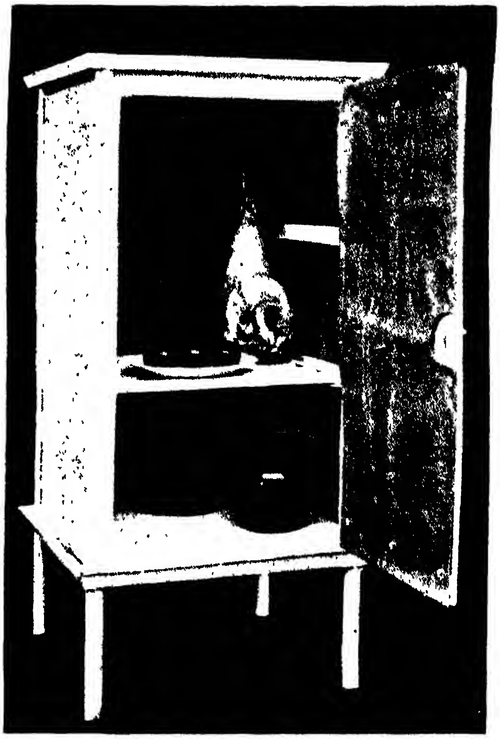
Freezing.

Although mechanical refrigerators are comparatively new, their use is spreading rapidly, largely owing to the new food regulations which prohibit the use of preservatives. Ice boxes have been used in private houses, to a limited extent, for many years ; as long ago as the seventeenth century Lord Bacon, the well-known philosopher, was interested in the preservation of food by cold.

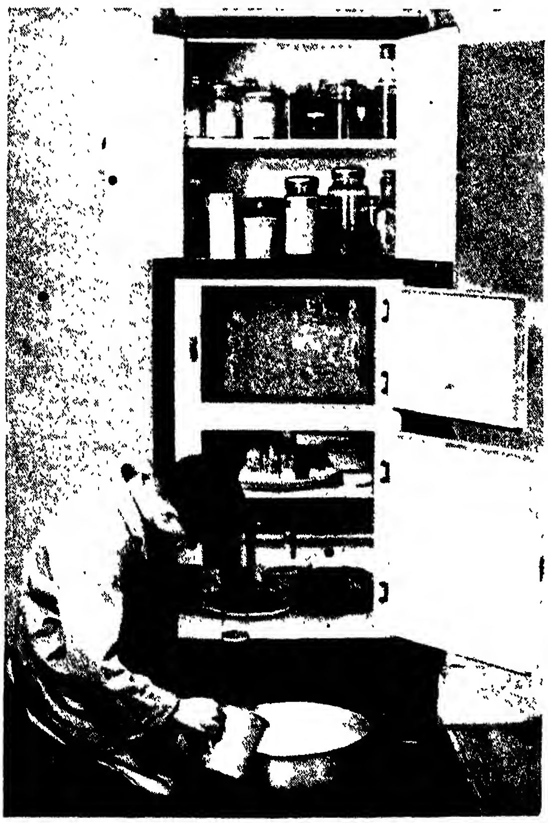
An efficient refrigerator, whether cooled by mechanical means or by the presence of a large piece of ice, must be well insulated so that heat transmission is reduced to a minimum, the inside lining should be non-porous and easy to keep spotlessly clean, the

cabinet so designed that the air within it can circulate easily, and the temperature should not rise above 45-50° F., even in the hottest weather.

Like other appliances, there are good refrigerators and poor refrigerators, depending on the care and accuracy with which the cabinets or boxes are constructed, and also on the nature, quality and thickness of the insulating material. The materials used for insulating vary, in fact some refrigerators are packed with layers of several different materials. Whatever is selected, it must be a poor conductor of heat. Materials often used are : compressed and granulated cork, wool felt, wood, waterproof paper, etc. Heat transmission is also guarded against by the use of porous substances. As air is a non-conductor of heat, materials provided with plenty of air spaces make a more efficient insulation than the same materials without air spaces.



A WATER-COOLED SAFE
The simplest form of cold storage. Evaporation of water from the canvas lining reduces the temperature.



AN ICE-COOLED REFRIGERATOR
The ice is placed in the upper chamber and there is a store-cupboard above—a very useful type of refrigerator where there is no electricity supply.

Although a large refrigerating cabinet with a hygienic jointless lining of white porcelain-enamelled iron, efficiently insulated and carefully ventilated, is not a cheap appliance, it is possible to obtain a small but soundly insulated ice chest for an expenditure of about £6.

So far mention has not been made of the means by which the "cold" is to be produced. A few years ago all domestic refrigerators were cooled by filling one section of the cabinet—called the ice compartment —with a large piece of ice. In order to melt ice, heat is required, and it is taken from its immediate surroundings with the result that the temperature inside the food compartment is lowered.

Mechanical refrigerators which automatically produce "cold" are now, however, used to a considerable extent. Several different types are on the market, the majority of which require electricity, but there are a few which require heat in some form instead of power, and these can

be operated either by gas or electricity, and so are proving specially popular.

PURE AND CLEAN FOOD

By FLORENCE RANSON

Not only must food be nourishing and in the right proportion, but it is just as important that it should be wholesome, pure and clean.

It is necessary to make sure that food is not adulterated with harmful chemicals, nor contaminated in any way by flies or dirt, and that it is served under perfectly cleanly conditions.

A very big step forward with regard to pure food has been made in the last two years, but even now a large proportion of food-stuffs are still " preserved." That harmful preservative, far too long tolerated—boric acid—is prohibited in all foods ; buns and cakes containing cream are now entirely free of this chemical, and as these foods are increasing rapidly in popularity, this is a most necessary restriction.

Margarine, butter, bacon, egg yolk, all common articles of food, must no longer contain this preservative and this regulation not only covers all home-produced foods, but imported ones also. Meat and fish in glass or tin containers, also all potted meat and fish must be unpreserved, and no longer may those injurious eggs, known technically as " liquid," but scientifically and truthfully as " boracised " eggs be put into our confectionery.

But outside these foods there is still a long and important range of articles of diet which may be preserved to a limited extent with two more or less harmful chemicals. These are benzoic acid, generally considered by scientists to be harmless to healthy people, and sulphur dioxide, concerning the effects of which scientists are divided in their opinion.

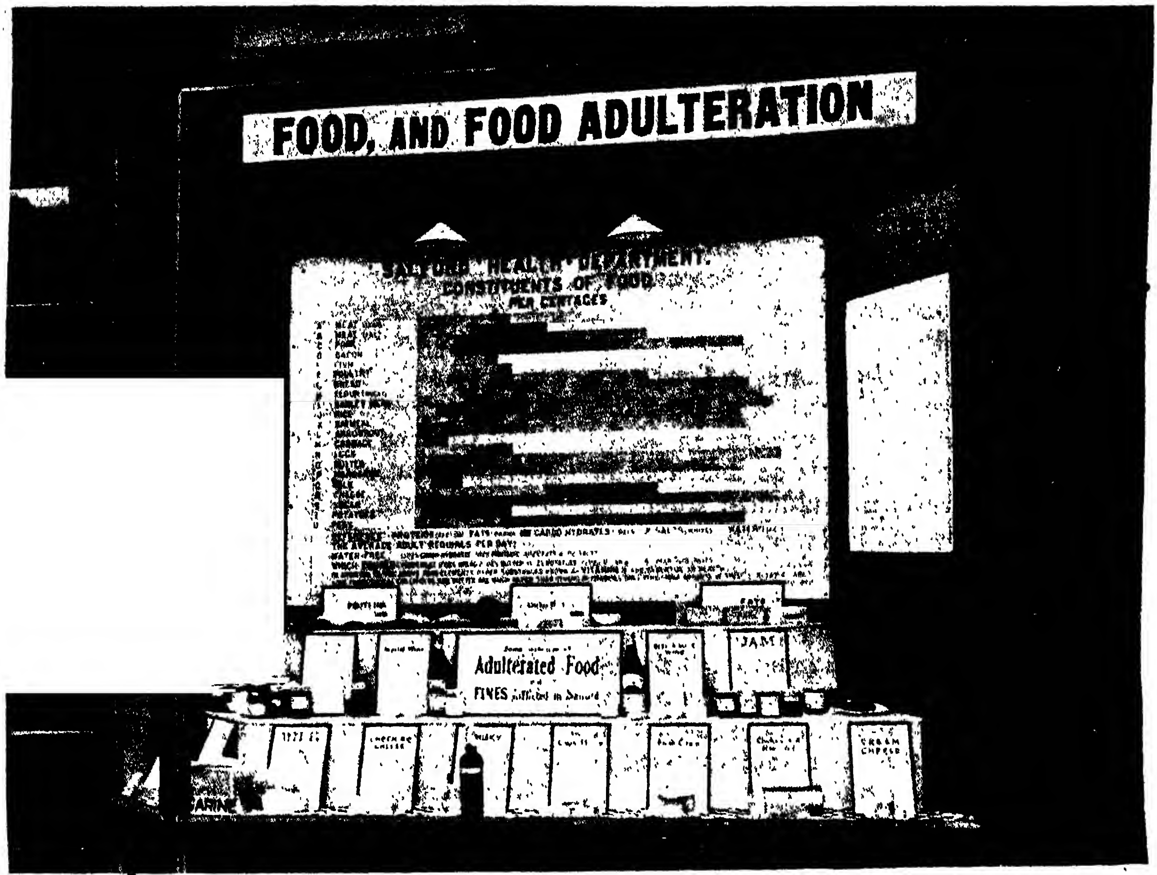
The report of the Departmental Committee which sat in 1923 to consider the use of preservatives in food, states :—

" Careful investigations in the last few years have shown that sodium sulphite in the amounts employed in foods has no specific toxic action, since it is rapidly converted into sulphate in the tissues. Nevertheless, we do not regard it as harmless, for, if food which contains sulphites is taken daily, the sulphur dioxide liberated in the stomach may cause dyspeptic symptoms."

The United States forbids this preservative in all meats, while our regulations allow it to be used in that extensive range of foods covered by the term " sausages and sausage meat." Sulphur dioxide may also be used in fruit pulp, dried fruit, jam, candied peel, sugar, glucose, gelatine, beer, wine, cider and mineral waters. Other foods in which it may be used, and these undoubtedly come under the heading of children's foods, are : cornflour and all other prepared starches (including, of course, custard and blancmange powders) marmalade and crystallised fruits, including cherries, largely used in the making of cakes.

Perhaps the most important clauses of this government order are those compelling all makers of foodstuffs who use preservatives to state clearly on a label on the packed article the particular chemical used. Educated public opinion will refuse foods so labelled, and choose always those foods guaranteed unpreserved. But the poorer housewives to whom the preservative label means nothing and the cheaper price everything, will still buy the less wholesome article. It is not till all foods are sold chemically unpreserved that we can be sure that the health of the community cannot be affected through these means.

The order also restricts very considerably the number and variety of colours used in foodstuffs. That there was considerable need for restriction is shown by the fact that the United States Government only allows 11 colourings to be used, while over 90 occurred in the lists of colours submitted as suitable for food purposes to the British committee when they were considering this question. In America, all margarine is white, uncoloured, just as nut butters are sold here, and this, apart from any question of healthfulness, is a much more honest way of putting



Courtesy] [*Medical Officer of Health, Salford*

A PLEA FOR PURE FOOD

A graphic display in the windows of a municipal health office, demonstrating food values and the dangers of adulteration.

on the market a substance which competes with cream butter.

Among the colours now excluded is copper sulphate, a far from harmless colouring agent used extensively by some manufacturers to keep tinned and dried peas and other green vegetables "a good colour." With this, too, have gone many injurious colourings used in the cheaper makes of sweets.

There are still, however, numerous prosecutions of traders using preservatives and forbidden colouring matter, and a strict watch must be kept by the public (especially housewives who have many opportunities of detecting these errors) that the regulations are everywhere being carried out.

There is little danger of preserved food being sent from other countries, for many of them were ahead of us with regard to their preservative regulations. Denmark has prohibited the use of preservative in butter, etc., ever since 1923; butter from Russia and Finland has always been unpreserved, while a part of the butter sent from Australia and New Zealand was preservative free. Meat has now for some years come from Australia, New Zealand and the Argentine unpreserved, depending on proper refrigeration for its transport in good condition.

CANNED FOODS

By JOHN CAMPBELL, Ph.D.

CANNED foods now hold an assured place in the world's dietary, and their production and preparation forms one of the greatest of modern food industries.

The preservation of food in tins prevents

enormous waste and enables the glut of seasonal production to be utilised and conserved for use throughout the year. New and increasing sources of existing production are encouraged, for so precise and rapid are modern methods of preservation that tremendous quantities can be adequately dealt with even in the limited time of the seasonal fruit and vegetable crops, and the periodic harvests of sea and river fish.

The fruit and vegetables of mother earth produced in such abundance in the sunlit zones of the world and fish food from the prolific seas are, by preservation in easily transportable forms, rendered available in every clime—immense distances from the source of supply and preparation.

This circulation of food from the restricted zonal areas of production ensures a more equable distribution of the world's food supplies, and contributes in no small degree to a more rational and balanced diet and to a higher and more healthful standard of living. It brings to our tables desirable variety in our daily rations.

The industry reaches its highest productive efficiency in the countries where the raw products are most abundant—America, Australia and South Africa. But fruit and vegetable preservation is making rapid progress in this country, and the number of firms that are laying down canneries for these purposes is being continually augmented, thus conserving our English crops of fruit and vegetables for table use by the masses all the year round.

The English canners preserve most English fruits—plums, greengages, gooseberries, damsons, raspberries, loganberries, strawberries and currants—and these products reach a very high standard of purity, with *natural* colour and flavour. English vegetables, especially peas, are also canned, the latter turning out after cooking bright and soft with a flavour equal to that of the fresh food.

Modern methods of canning aim at the elimination of waste material; the harvesting of the fresh foods at the best time; complete sterilisation (protected from oxidation) within the shortest period of time, and at the lowest temperature compatible with permanent stability, and the elimination of the danger of metallic poisoning. That these objects are successfully achieved by the canning industry is proved by the infinitesimal proportion of tins that are found to be defective or unsatisfactory from the health standpoint.

The world owes a debt of gratitude to those food experts working with the manufacturers who have, by patient research and experiment, brought the preserving processes to their present state of efficiency.

Food Value.

The old idea that tinned foods are greatly inferior in nutritive and caloric value to the fresh foods from which they were prepared is now known to be wrong. The contrary is the truth. Generally they have a higher protein and caloric value, on account of the lower water content, the removal before preservation of waste parts (like bone, gristle, and offal), and the addition of accessory ingredients like oil, gelatin and sugar.

In fresh fish, as purchased, for example, the waste may reach 70 per cent., but when canned the whole of the contents are edible.[1] In tinned salmon the waste falls from 40 to 14 per cent., and in lobster it is nil. In those foods which need no cooking there is a further saving of coal, gas, or electric current.

Canned fruit also yields the fruit acids and salts in their natural condition, and roughage in the form of cellulose and fibre. The latter is much softened by the preserving processes and gives the necessary intestinal bulk without undue irritation. Nor is the flavour adversely affected except in a very few instances. In many fruits, indeed, the flavour is developed and preferred by most people to stewed fresh fruit. This is especially the case with stoned fruit.

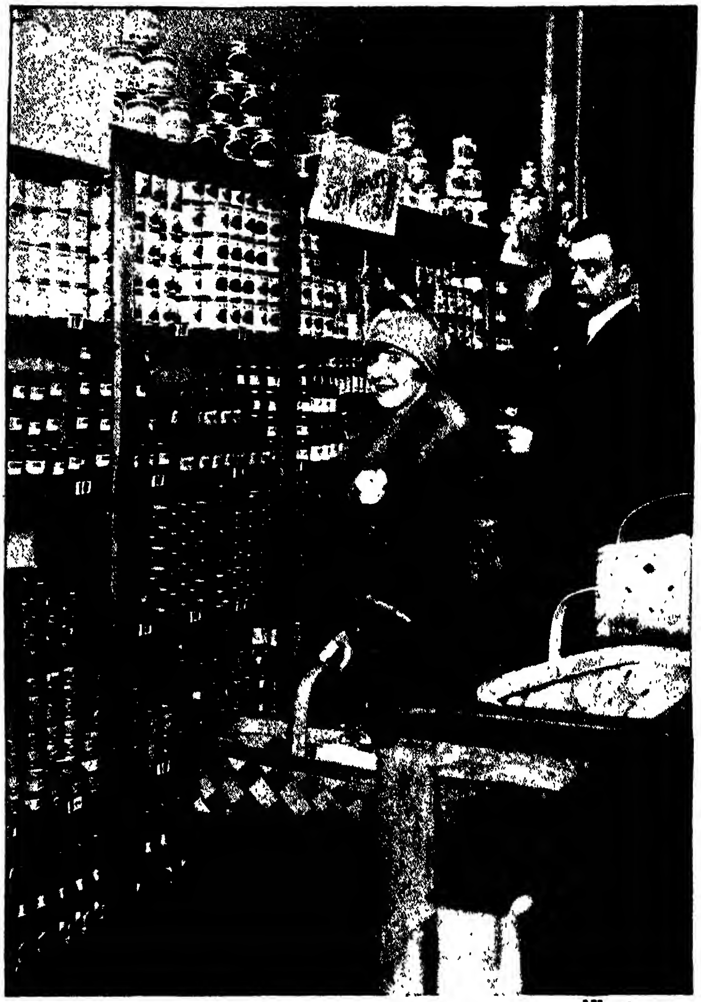
Vitamins.

It was long thought that the high temperature to which preserved food was subjected destroyed the vitamin content. But this theory has been proved to be wrong. It was based on insufficient data

[1] For further information see Bibliography under corresponding number (page 1450).

and incomplete knowledge of the exact conditions under which vitamins are destroyed. It is now known that the factors of oxidation and time are of first importance in the destruction of vitamins—within the specific limits of thermal action[3] proper to each vitamin.

In modern canning processes the sterilising is completed as rapidly as possible in the sealed tins, thus protecting the contents from the action of air, and the vitamins are thus preserved from destruction. In animal foods, like soups and fish, it has been proved that there is no loss of vitamin content during the preserving processes. In the brands submitted to biochemical tests it was found that they were richer in vitamins A and B than green vegetables or milk.[4]



[Keystone

A CANNED FOOD STORE

A New York grocery store devoted exclusively to the sale of canned goods. A full and varied meal can be obtained for 25 cents (one shilling).

In vegetables and fruit the chief vitamin present is water-soluble anti-scorbutic C. This vitamin is more sensitive to thermal action than either A, B, D or E, but, provided the food is protected from oxidation and the action of alkalies, and the period of heating is short, little or no destruction takes place.[5] Modern preserving operations fulfil these conditions, and recent researches show conclusively that canned fruit has a full vitamin content. Canned tomatoes, peas, apples, peaches, were found to undergo no loss of vitamin C and to be richer in that element than fresh orange juice. Canned spinach is richer in anti-rachitic vitamin D than butter and almost equal to cod-liver oil in that respect. Storage for three years had no deteriorating effect on the vitamin content.[6]

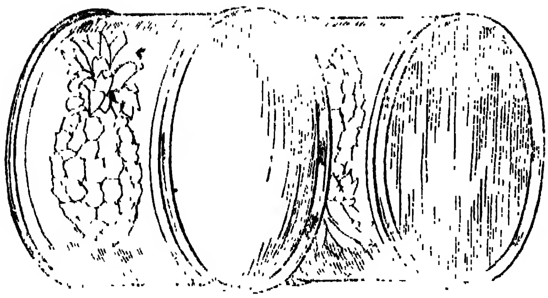
To many people all canned food is suspect on account of the fear of poisoning. But

Poisoning.

under modern processes the danger of infection may be dismissed. Occasionally cases of microbic infection have been traced to the consumption of canned foods, but these are so rare in relation to the millions of tins used for culinary purposes, that the degree of absolute safety has almost been reached. It is certain that there are far more cases of disease from the consumption of tainted or infected fresh food than from preserved foods.[7]

Sir William Willcox, the eminent authority on toxicology and scientific advisor to the Home Office, pointed out in his address to the London Chamber of Commerce that "Ptomaine poisoning from the consumption of canned foods was so rare that we may dismiss it." *

* See section on "Food Poisoning."



A TEST OF PURITY
The end of the tin should be slightly concave; bulging ends are a sign that the contents have fermented.

In the same lecture he mentioned that in his military experience during the war not a single case of food poisoning occurred from food being infected in the unopened tin. Millions of troops were fed for years on canned foods, and the evidence of poisoning was nil. The sources of contamination were to be found in the house and not as a rule in food supplied by the provision trade. It was usually the food in the kitchen.

In the early periods of the canned industry when solder was used in conjunction with naked metal there was evidence of a certain degree of metallic contamination from the action of the acids on the metal. Under modern processes this danger has been entirely eliminated by the use of internally lacquered tins and other precautions which prevent the formation of the deleterious metallic salts.

Sir William Willcox, referring to this point in a lecture said, "The danger of metallic poisoning from tinned foods was nil. I have never met a case in a fairly large experience of food poisoning." [8]

Efficiently prepared tins show slightly concave ends. Bulging ends indicate internal fermentation and decomposition with the formation of gas, which under pressure distends the ends.

The entire contents of all canned foods should be emptied into glass or earthenware dishes immediately after opening and consumed as soon as is practicable. The public should confine their purchases in canned foods to branded goods packed by reputable firms giving the source of origin, and who assume full responsibility. By doing this they are assured of the purity and quality of the goods they purchase.

Method of Use.

Canned foods may be regarded as essential to modern dietary. In a safe and practical form they conserve the harvests of the orchard, field and sea for human consumption independently of seasonal crops and catches, and enable less favoured countries to share in the prolific food production of zones thousands of miles from the ultimate markets. They are economical and efficient in nutrition, adding an infinite variety to our daily dietary, throughout the year.

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COOKING AND HEALTH

APPETITE AND DIGESTION

By SIR FREDERICK MOTT, K.B.E., M.D., B.S., LL.D., F.R.C.P., F.R.S., Late Lecturer on Morbid Psychology at the University of Birmingham.

WE speak of food being appetising on account of its savoury smell, or because of its flavour, but flavour of food is largely due to the sense of smell rather than taste, though we taste sweet and bitter things and acid and salt substances. Now a savoury odour of cooked food effects through the sense of smell a psychic process,

which, starting the desire to eat, causes a flow of the digestive juices before even the food enters the mouth ; and it has been shown that not only does the mouth water at the smell or even the sight of appetising food, but that the gastric juice also begins to flow. On the other hand, if the odour of the food is unsavoury, or the food has neither flavour nor savour, and there is little or no desire to eat, this appetite juice does not flow. Fear, worry, and anxiety stop the flow of the appetite juice, and therefore, unless there is a strong stimulus by a savoury smell of cooked food, a mentally tired man has little or no desire for his meal when he comes home after a long day at his work, profession, or business. In some cases of insanity where there is marked mental depression, food is refused, and the late Dr. Maudsley told me that he was once called to a case of this character, when the idea occurred to him of using the stimulus of a savoury odour of cooked food to overcome this aversion, so he had some cheese toasted. The smell of the savoury toasting cheese made the man ask what was cooking, and he was induced to eat.

The sense of sight also plays an important part in the psychological anticipation stage of eating a meal. The food should not only please the sense of smell, but also the sense of sight, by the way it is put on the table ; the clean tablecloth, the napkin, the hot plates, and the garnishing of the dish with parsley, watercress, etc., all help to promote a pleasant psychic state and the flow of the appetite juices, whereas a slovenly and dirty or unpleasing table promotes a feeling of disgust and a failure of the flow of the appetite juices. An unvitiated palate is Nature's best guide for the nutrition of the individual.

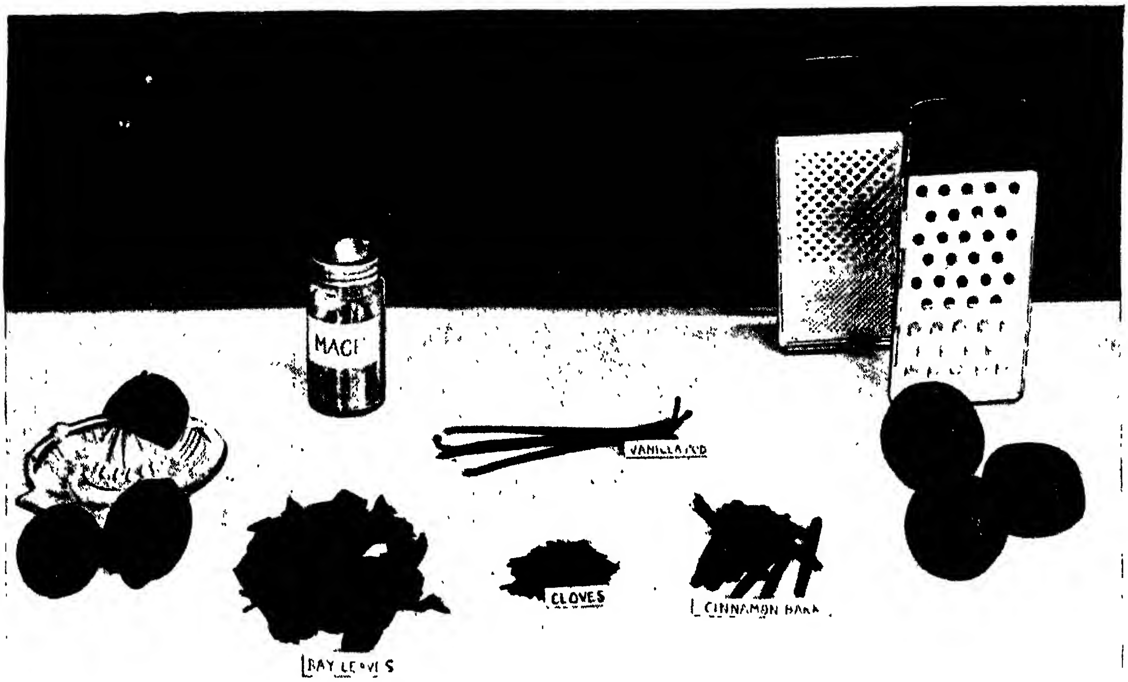
Varied Menus.

When I had charge of the Neurological Clearing Hospital in London I realised the importance of attending to these appetising influences in the promotion of convalescence of neurasthenic officers. Another very important matter in relation to the feeding of invalids, especially neurasthenics, is monotony. When a particular bill of fare is always associated with a particular day of the week, as so often occurs in hospitals and institutions, it has an unappetising effect, and to an irritable, nervous man or woman may be such a source of annoyance and irritation that it may cause discontent, and even aversion of wholesome nutritious food. A pleasant gastronomic surprise by a wife to a tired and irritable husband on coming home will often be an appetising tonic, and sometimes even be the means of preventing domestic quarrels. Indeed, doctors, if they would attend more to promoting the flow of the appetite juice by giving their attention to appetising food, might dispense with tonics, which in my opinion owe their value largely to the faith the bitter taste inspires. Cocktails and *aperitifs* are only required by persons who have lost the natural appetising influences of savoury, well-cooked food. I have often thought that doctors and nurses do not pay half enough attention to the preparation of wholesome and appetising invalid food, and I am of opinion that all nurses should have a course of training whereby they can acquire a practical knowledge of the subject and of its importance in the care of the sick and in convalescence.

Invalid Cookery.

I remember that great and experienced physician, the late Sir William Broadbent, telling me how frequently in hotels and the houses of the wealthy it was very difficult to obtain suitable food for patients. The chefs did not understand, and the nurses either had not sufficient authority or interest or knowledge to see that the food of the invalid was suitable. He, therefore, knowing the great importance attached to proper food being given to his patient, would himself go into the kitchen and instruct the cook in the preparation of suitable food. Afterwards he would when visiting ask for the food to be brought that he might taste it.

A delicate flavour to food often increases the desire, and, instead of making wholesome food indigestible, it makes it more digestible by the pleasant psychic influence inducing a flow of the appetite juice, and the consequent desire for more.



SOME HARMLESS NATURAL FLAVOURINGS
Lemon juice, grated orange peel, bay leaves, cloves, cinnamon, mace, and vanilla—harmless flavourings that are indispensable in the kitchen.

Cooks, however, show their intelligence and special aptitude for the art, not only by making their dishes pleasing to look upon, but by their capacity for giving a flavour to food by sweet herbs, peppers, and essences. Those who leave flavouring agents and condiments out altogether are not so bad as those who use them with such a heavy hand that wholesome food is made distasteful or even disgusting. For example, garlic is a most valuable flavouring agent, but it may be disgusting to English people if more than a suspicion is in the food. It is related that a celebrated cook was once asked how he obtained this suspicion, or, as the French say, *soupçon*, in his salads. He said, " I breathe on it," but then he chewed garlic.

In conclusion, we hear a great deal about people drinking too much alcohol, but very little is said about eating too much. Physicians warn middle-aged people against the dangers of over-eating, especially red meat, resulting in high-blood pressure with thickening and loss of elasticity of the arteries and a tendency to apoplexy. The warning often comes too late, and sometimes it is disregarded.

Fortunately the public are coming more and more to see the wisdom of preventing disease, and one way is the advancement in knowledge and practice of dietetics. Lastly, we cannot do better than follow the wise and commonsense principles laid down by Voltaire: " Regime in diet is better than medicine. Eat in moderation what you know by experience you can digest, for only that which you can digest is good for the body. What is the medicine which makes you digest? Exercise. What will repair your energy? Sleep. What will lessen incurable ills? Patience. What will change a bad constitution? Nothing."

HARMLESS COLOURS AND FLAVOURINGS

By JOHN CAMPBELL, Ph.D.

THE artificial colouring and flavouring of basic food is not necessary from the nutritive or dietetic standpoint, but there is a good

deal to be said in favour of the practice from the æsthetic and gustatory points of view, in rendering foods more pleasing to the eye and nearer in appearance to the fresh condition, and more appetising and acceptable to the palate.

Many kinds of stewed fruit, for example, are improved in appearance by a touch of red, and some vegetables are freshened up by the use of a green. Jellies and blancmanges, suitably tinted, confer a distinctive artistic note to the sweet course and help to brighten the appearance of the table.

The pleasing effects on the eye of harmonious colour, gleaming glass and spotless napery—the appetising odour and flavour of freshly cooked food on the olfactory nerves, and the palate—have a notable effect conducive to a mental condition most favourable to secretion, and have a distinct influence for good on the digestive processes.

There are numerous harmless natural colours, both vegetable and animal, which may be used for tinting purposes in the kitchen.

Reds.—The following may be used :—

Cochineal and its derivative, carmine, obtained from the insect Coccus cacti.

Logwood derived from logwood chips.

Beetroot juice from expressed cooked beetroot.

Yellows.

Saffron extract from the dried stigmas and styles of the Crocus sativus.

Turmeric prepared from the root of the Curcuma longa.

Orange.

Annatto obtained from the seeds of the Bixa orellana gives a light orange.

Safflower prepared from the flowers of the Carthamus tinctorius gives a deep orange.

Greens.

This colour is conferred generally by chlorophyll, the green colouring matter of plants.

Spinach extract or liquor gives a general green. Parsley a light bright green.

Blue.

Litmus or orchil derived from lichens, chiefly Roccella tinctoria and Lecanora tinctoria, may be used when the foods are not acid.

Indigo.

Brown.

Caramel from burnt sugar.

Alkanet prepared chiefly from the roots of the Anchusa tinctoria.

Violet.

Litmus at a certain degree of acidity produces violet.

Cochineal prepared with lime water.

These colours are non-poisonous and may be used with every confidence. In addition natural fruit juices impart their specific colour to the foods to which they are added.

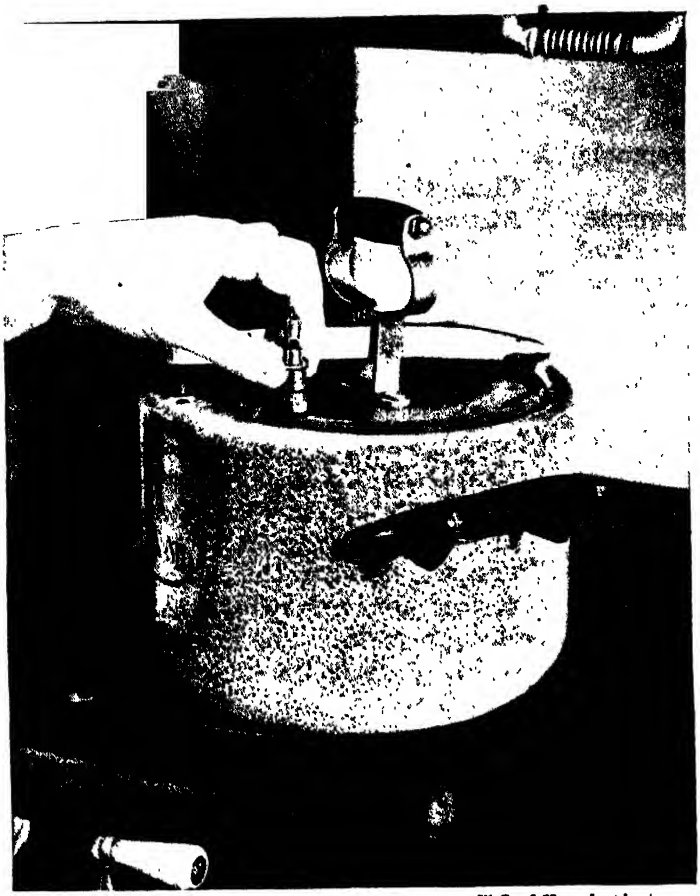
Mineral colours formerly largely used—Prussian Blue, Yellow Ochre, Salts of Copper, etc., need not be discussed as they are now no longer employed for tinting purposes on account of their harmful and poisonous characters.

Aniline Colours.—These concentrated dyes, so vivid when diluted, are prepared from coal tar and are largely used to colour confectionery. There is considerable difference of opinion among dietitians as to whether the anilines are absolutely harmless. Probably in the infinitesimal proportions in which they are present in sweets and preserves they have no deleterious effect. But when so many natural colours are available for the kitchen, there is no advantage in their use.

ESSENCES AND FLAVOURS

These are derived mainly from fruit, flowers, seeds, nuts, barks, roots and beans. The aromatic and flavouring constituents consist mainly of volatile ethers, aldehydes, and essential oils usually derived from nuts and fruit peel.

Fresh fruit juices are the safest sources of flavours for jellies and starch moulds, but fruit essences may be used if prepared from fresh fruit. These are usually alcoholic extracts holding in solution the flavouring ethers and aldehydes in a concentrated form from various fruits. (Raspberry, strawberry, cherry, etc.) In a different class are the



Courtesy] [" Good Housekeeping"

A NEW PRESSURE COOKER

Adjusting the whistle to regulate the pressure in a modern type of quick cooker.

flavouring essential oils derived from rinds and nuts. These are safe and handy to use, and obviate the necessity of using peel. They include, lemon, orange, almond and peppermint. Other harmless natural essences are vanilla and coumarin (tonka bean).

Many fruit flavouring essences can now be synthesised by the chemist and resemble the natural flavours very closely in their general characters. For example apple essence is amyl-valerianiate dissolved in alcohol, pine-apple essence is butyric ether in alcohol, and pear essence consists of amyl-acetate in alcohol.

Artificial Essences.

It is not advisable to use these artificial essences because for household purposes natural flavouring constituents are usually available. In lieu of the freshly expressed juice of the fresh lemon, or orange, one of the bottled preparations may be used. These are very convenient and represent the natural fruit juice in a preserved concentrated form.

In addition to the essences, many spices and herbs are used in more or less their natural state for improving the gustatory and digestive properties of food. Omitting the stimulating condiments like mustard and pepper, cloves, cinnamon, ginger, mace, nutmeg, caraway seeds, coriander, aniseed, cassia, cardamom, thyme, sage, mint, fennel, parsley and majoram impart specific and pleasing flavours and aroma to food. Some of them also serve as harmless stimulants to salivary and gastric secretion, and others, like mint, act as antiseptics and counteract the tendency of certain foods to produce flatulency.

The artistic use of harmless colours and the moderate addition of natural flavouring adjuncts to our food should play an important part in the table presentation of our daily dietary. The practice adds very considerably to the enjoyment of a meal and favourably influences in many ways the digestion and assimilation of food.

A COMPARISON OF COOKING METHODS

By ELIZABETH EDWARDS, *("Good Housekeeping" Institute), First Class Diplomas in Cookery, etc.; King's College Certificate in Household and Social Science.*

THE chief objects of cooking food are to give palatability and digestibility. Raw foods, such as meat, are rendered more palatable, although, if anything, less digestible, and vegetables which consist largely of starch and cellulose are made more digestible. There is a variety of means of achieving these two objects. In the main, methods which do not appreciably decrease the digestibility of

proteins in meat and other foods, and which conserve as much of the food value as possible, are those most to be commended.

The practice of cooking meat by the direct rays from a clear fire, *i.e.*, roasting, has largely fallen into disuse. It is the most savoury way of cooking meat and fowls. Its place has been taken by BAKING. This is carried out in an oven and the meat is surrounded by and cooked in dry heat. Provided that the meat be subjected to great heat, at first 450°-500° F., to harden the protein on the outside and prevent the escape of the juices, and that the rest of the cooking be carried out at a temperature of 360°-380° F., the protein throughout will not be unduly hardened. In order to keep the outside moist and to develop the particular savoury flavour associated with a baked joint, the meat should have fat poured on it at frequent intervals. From experiment it has been observed that even with care a 4-lb. joint of beef will lose 1 lb. 3 oz. or a 4-lb. joint of mutton, 1 lb. 4 oz. This loss becomes much greater when the meat is cooked at too high a temperature, which also renders the protein more indigestible. Owing to the fact that baking hardens rather than softens the fibres of meat, relatively expensive joints have to be used. Special roasting tins can be procured to eliminate the loss from baking as far as possible. They have a cover which minimises the evaporation of water and loss of fat, thus proving an economy. They also prevent the fat spluttering and soiling the sides of the oven. On the whole, however, baking must be regarded as a somewhat expensive method of cooking.

BOILING is a method which can be used for fish, meat, puddings and vegetables. Fish should, however, not be actually boiled as the force of the water breaks the flakes, but should be put into hot water. Owing to the fact that a good deal of flavour is lost it cannot be recommended as a suitable method for fish. Meat must only boil long enough to harden the protein on the outside, thus it should be plunged into fast boiling water and

Courtesy] ["Good Housekeeping"

THE HAYBOX METHOD

The contents of the casserole are brought to the boil, and then left to simmer tightly packed away in the haybox—a slow method, but one involving great saving of fuel.

the cooking continued at simmering point after the first five minutes' boiling. Slow, steady cooking is essential, as in roasting, to prevent the protein from becoming hardened. The liquor in which the meat is boiled should be used for broth or soup and thus nothing need be wasted.

Root vegetables, as with meat, are often cooked in too much water. In each case sufficient just to cover the food is all that is required. Mineral salts and a certain amount of starch are lost when vegetables are boiled, unless the water is retained for soup. A more suitable method of cooking them will be dealt with later.

STEAMING can in many ways be regarded as a method of conservative cooking, particularly if the food be steamed in covered containers. The food is cooked by being surrounded by steam and this is collected over boiling water in a special container, or the vessel containing the food stands in boiling water which reaches half-way up the vessel, the rest of it being surrounded by steam.

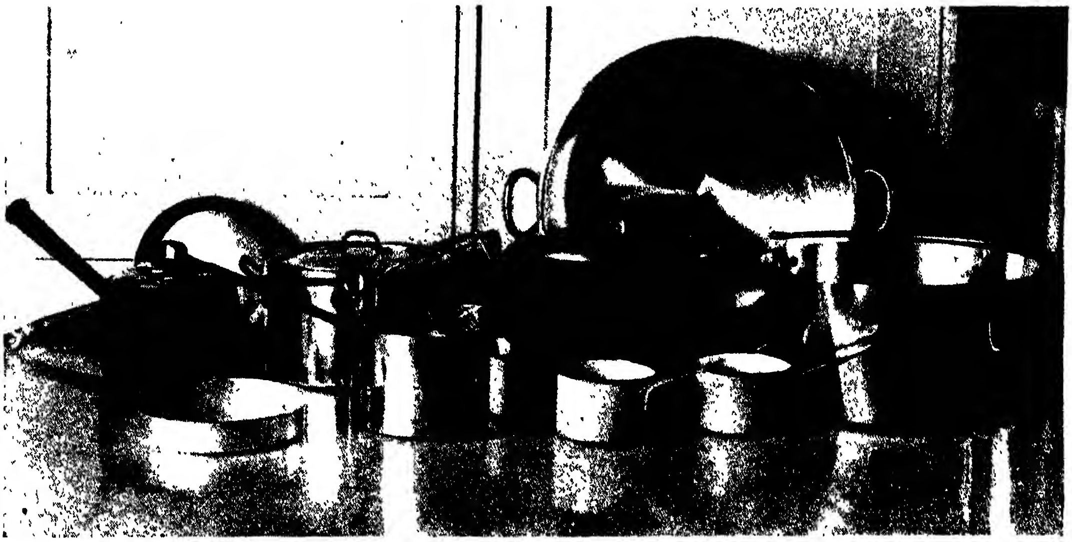
As the heat has to penetrate the vessel before reaching the food, this is a longer method of cooking than boiling, but one to be preferred on account of the lack of waste and retention of flavour. This method is suitable for fish, vegetables, puddings, and small pieces of meat.

FRYING is usually regarded as the most savoury and also as the least digestible method of cookery. It can be carried out in two ways. The more digestible way is that known as deep fat frying, in which the food is put into fat at a temperature of 360°-380° F., left there from 1 to 3 minutes and lifted out. The high temperature hardens the outside of the food—usually a coating of egg and crumbs—and prevents the entry of fat. The food soon cooks in the high temperature. Properly cooked, fried food, such as fish, is just lightly set in the centre. Its disadvantage is that this method is only suitable for small pieces of food or for re-heating previously cooked food. Badly fried food is certainly indigestible as the fat at a low temperature soaks into the food. In any case the slight coating of fat on the outside tends to retard the digestion of the food, but when the fat has soaked into the food the indigestibility is increased. When carrying out deep and shallow frying the correct temperature is important. Shallow frying is carried out in hot fat from which a faint blue smoke arises, the fat reaching half-way up the side of the food. Steak, eggs and chips are frequently cooked by this method, but frequently they are overcooked, and the protein is hardened and rendered indigestible. Owing to the good quality of the food required, as this method does not make food tender, and to the fact that the food shrinks, it must be regarded as an extravagant method of cooking.

GRILLING is a suitable method of cooking for fish, kidneys, and steak. Here again, as in the case of roasting, good quality food is important as the intense heat hardens instead of softens the fibres. In this process the food is cooked quickly on both sides under or over clear, red-hot heat. This is carried out so quickly that the outsides are cooked and the inside is lightly set, and there is little or no loss of food value.

Meat, vegetables, fish, cereal puddings and fruit can all be cooked by the process known as STEWING. It can be carried out in a strong, tightly covered pan or casserole in the oven or over an open flame. Of all methods it is the most suitable for the cheaper cuts of meat, and also for cereals, vegetables, cheese and eggs. Little liquid is required and the flavour and "goodness" are retained in the liquid and served with the dish. Thus there is no loss of food value. The temperature is so moderate that the protein of meat, eggs, milk and fish is lightly set and not over cooked. It is regarded as the most economical method of cookery, since the cheaper cuts of meat can be used, and it can be carried out at a low temperature.

Developments of stewing are the conservative method of cooking vegetables, and hay box cookery. There is no doubt that from the point of view of food value and flavour these conservative methods of cooking are the most economical. Vegetables, instead of



SOME UP-TO-DATE KITCHEN UTENSILS

The choice of materials for modern cooking utensils includes enamel ware, aluminium, copper, and cast iron.

being cooked in bulk in a large amount of water, should be sliced and placed in a strong covered pan or casserole together with salt, a lump of dripping or butter, and half an inch of water. The cooking should be carried out in a moderate oven or over a low light. Occasional stirring and replenishing with water may be necessary. Root vegetables will take on the average half an hour. In order to assist in preserving the good colour, greens should be prepared as usual and boiled for five minutes in fast boiling salted water. After that they should be drained and the large leaves sliced. Proceed then as for root vegetables, but omit the water. Shake gently from time to time. In this way the mineral salts and starch are retained ; the cellulose is softened, and the flavour is most delicious.

There are of course several cookers of the conservative type available, some of them generating steam under pressure. A joint of meat and vegetables cooked in these are most delicious.

In the hay-box, or its up-to-date equivalent, the fuelless cooker, the food is slowly stewed in the heat which is retained by a careful lining of the box with insulating material. The food is brought to the boil and cooked for a short time, according to its kind, and then promptly put into the box and closed from the air. The non-conductive material, such as hay or asbestos, prevents rapid loss of heat and at the end of a few hours the food will be cooked and still warm. Some of the more up-to-date fuelless cookers are properly fitted out with special containers, so that a variety of foods can be cooked at once. Heated discs keep up the temperature and the whole is so constructed that rapid loss of heat is prevented.

Enough has no doubt been said to show that a good deal of valuable vegetable material goes down the sink, and the protein foods are more often than not overcooked and rendered indigestible. Conservative methods of cooking, if adopted, will obviate this and bring additional pleasure to eating by the retention of the natural flavour of the food.

COOKERY UTENSILS

By D. D. COTTINGTON TAYLOR, Director of the "Good Housekeeping" Institute.

Fashions change in household appliance as in clothes, although the process is very much slower. Thus aluminium, glass and glazed fireclay are used extensively to-day for cooking appliances, whereas only a few

years ago they were hardly known, and copper, cast iron, seamless steel and enamelled iron were the metals from which saucepans and boiling pots were made.

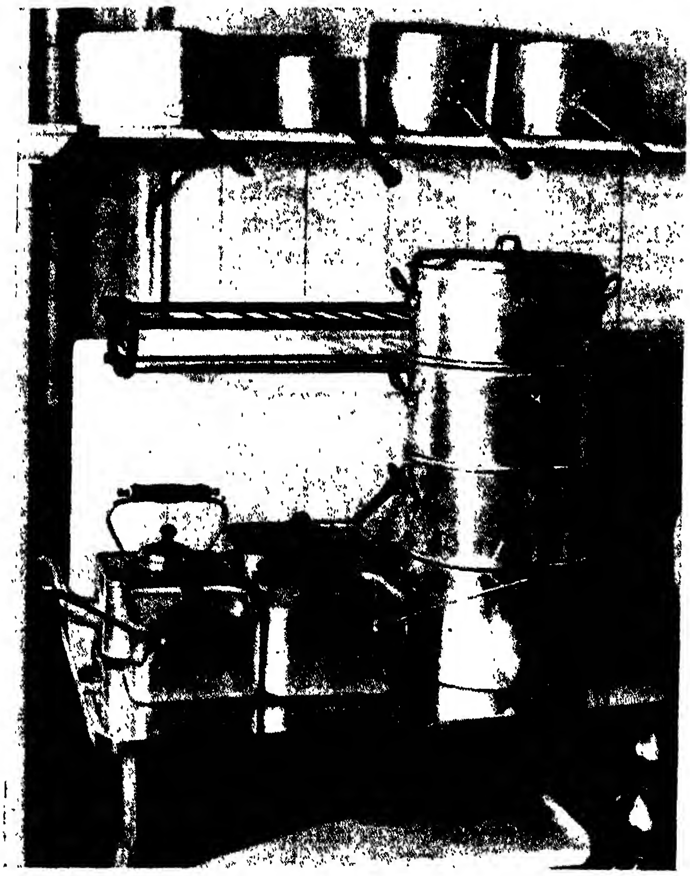
Aluminium.

It is interesting to recall, now that aluminium is enjoying such popularity, that when first introduced it was regarded with suspicion by the housewife. Its cheapness, lightness, durability, non-corrosiveness and ease of cleaning undoubtedly explain why aluminium kitchen appliances of all kinds are so widely used. Recent research work indicates that it is unaffected by the action of weak acids found in foods, principally fruit, therefore aluminium may be considered as being specially suitable for preserving pans in which jam and pickles are cooked.

This metal has one small disadvantage, viz.: that it is acted upon by a solution of washing soda. As the majority of household workers use soda in some form or another—often mixed with powdered soap—it is important that they should avoid using such preparations for washing up aluminium ware.

A strong, hot solution of washing soda actually dissolves minute particles of the metal, very small bubbles of hydrogen being evolved at the same time. If, therefore, soda water is regularly allowed to remain in contact with aluminium the surface becomes pitted and rough.

Under ordinary circumstances no special cleaning is required, for, unlike copper and other metals, it does not tarnish or oxidise, therefore cleaning, in the strict sense of the word, is not necessary.



UTENSILS WHICH SAVE SPACE AND FUEL
Four square pans can be kept hot over one gas ring, and a complete dinner can be cooked in the tier steamer.

Aluminium used for domestic purposes often contains minute traces of other metals, chiefly iron, and, as a result, boiling water discolours it. This darkening is not, however, in the least detrimental and it can be removed quickly by boiling anything of an acid nature; such as apple and lemon parings, in the pan. Housewives who wish to keep aluminium very bright are recommended to use a very fine grade of steel wool and soap, or a fine abrasive cleanser, such as whiting and soap.

Aluminium utensils may be cast, spun or stamped. Cast pans stand extremely hard wear and consequently are specially to be recommended for large scale and institutional cooking. For ordinary household use, pressed pans are generally used and these are less expensive than those made by casting, and the method of manufacture—by exerting equal and heavy pressure—is such that the thickness or gauge of the metal is more or less uniform. Spun aluminium saucepans are very

cheap, but they have the disadvantage that in the process of manufacture the bottom, where it is desirable that the metal should be thickest, is often thinner than the sides.

The subject of aluminium pans should not be dismissed without mention being made of square saucepans. These are of pressed aluminium and so shaped that four pans can be kept boiling over one gas ring or electric element. Thus by placing two or four pans close together the utmost use can be made, not only of the space available, but of the heat produced.

Pans of cast iron are specially suitable to use on a coal range or open grate. They are durable—in fact, unless dropped, when they are liable to crack and break, they wear almost indefinitely—and are very cheap. Care is required to keep them free from moisture or rust forms, and, if neglected, difficulty is experienced in removing it, but provided they are washed out after use and the inside wiped with a dry cloth, they will remain in good condition.

Cast Iron.

For boiling milk, making light coloured soups and preparing white sauces, a cast iron pan with an enamelled interior is recommended. This type should not be confused with the so-called "enamelled tin" pans, which are stamped from thin sheet iron, and enamelled both inside and out. The latter are extremely cheap and are useful for boiling water, vegetables, etc., but being very thin, food is liable to burn and the enamel to chip. On this account such pans are not suitable for general cooking, and cheap spun aluminium ware has largely superseded them.

Enamelled pans are not suitable for jam making as the acid contained in the fruit spoils the enamel. Moreover, as lead is frequently used in the manufacture of enamel, it is advisable to use either an aluminium or iron pan for this purpose.

Copper has lost much of its popularity for cooking appliances, not only on account of its cost but chiefly because the present day housewife is keen to save labour when possible. Copper has advantages over other metals but it has one great disadvantage, it corrodes and tarnishes very rapidly, and hard work is required to keep it clean. Moreover, verdigris, one of the salts liable to form on copper if it is neglected, is poisonous, and therefore it is essential that copper cooking appliances be kept scrupulously clean. Having emphasised the one unfavourable characteristic, the reasons why copper is used so extensively for culinary utensils that are required to stand hard wear, must be given.

Copper.

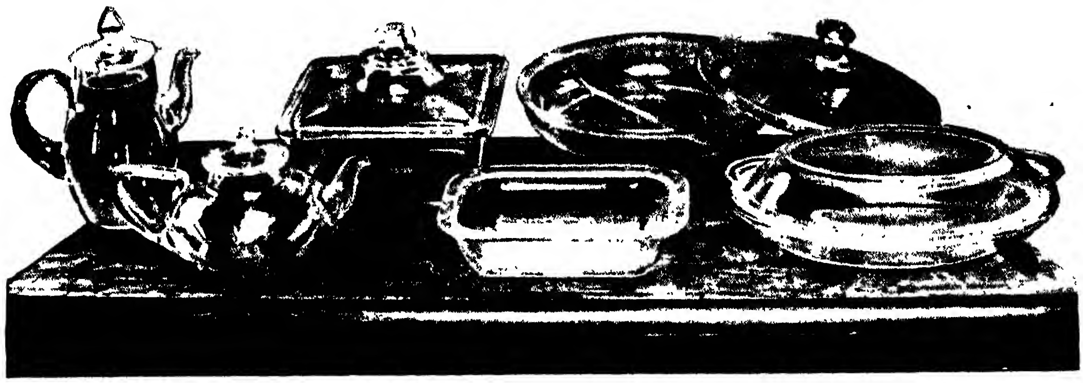
(1) It is extremely strong and tough, rough handling and careless use do not damage it, in fact pans of average thickness do not dent when dropped. For this reason it is used extensively in large kitchens of private houses and business establishments.

(2) It has a high specific gravity and is a very good conductor of heat. This explains why jelly moulds are frequently made of copper, for when unmoulding, an almost instantaneous dip into hot water is sufficient to melt the jelly.

(3) It does not wear readily, but when repairs are required no difficulty is experienced in patching and rivetting. This is in marked contrast to aluminium, which cannot be soldered or mended easily.

(4) It has a high melting point and therefore can be used at a high temperature without being damaged. Although for general purposes copper saucepans are tin lined, pans which are liable to become exceptionally hot, *e.g.*, caramel pans, are not lined, on account of the low melting point of tin.

The drastic method of scouring with silver sand and soap to clean copper in no way harms it, and is a very quick way of polishing the outside of saucepans, but this is not a suitable method of cleaning the inside if lined with tin, for it wears the tin unnecessarily. Unless food is burnt on, the interior only requires to be washed with hot soda water. Powdered bath brick applied with a soapy cloth and any of the well-known abrasive cleaners or steel wool can be used for the cleaning of any copper cooking appliance.



GLASS COOKING UTENSILS
An attractive type of modern utensil which is fire-proof and allows the contents to be seen during cooking.

Of the two classes of cookery utensil, fireproof earthenware and oven glass-ware, glass has the great advantages of being transparent, and therefore the worker who uses it for such purposes as cooking fruit and meat pies or cakes can see whether the food is cooked or not, and with reasonable care fireproof glass stands hard wear and is recommended for any cooking carried out in an oven. Casseroles of all shapes, ramakins, cake " tins " and pie dishes, are some of the many different articles now obtainable in this special heat-resisting glass.

Fireproof China and Glass.

Glazed fireclay is another material which is very popular for oven cooking, although its uses are chiefly confined to the preparation of food which requires long, slow cooking, such as stews and soups. It can, however, be used with equal success on the hot-plate or in the oven. If used over a gas flame or electric element, it should be protected from breakage by the provision of an asbestos sheet. The less expensive variety of earthenware cooking pots are those of French fireclay glazed on the inside. Specially attractive for table use are the fireclay china casseroles and marmites which are now obtainable in soft shades of blue, primrose and green as well as white.

When purchasing cooking fireclay only that of which the glaze is guaranteed leadless should be selected, since lead is highly poisonous and small particles may be absorbed with the food.

THE COOKING OF WHOLE GRAINS

By ELIZABETH EDWARDS, (" Good Housekeeping " Institute), First-class Diplomas in Cookery, etc.; King's College Certificate of Household and Social Science.

Modern research work in dietetics has shown clearly that the habit of consuming large amounts of highly milled cereals is fraught with danger to the health of the community. Flour, rice and various patent grain preparations are deprived of certain essential constituents during the milling. Briefly, these can be summed up as the layers of bran, containing mineral salts and vitamins (in particular vitamin B). The remainder of the grain—the endosperm—consists largely of starch, with a varying proportion of protein according to the grain in question. It is therefore of the highest importance that whole grains and whole grain preparations should be included in the diet. Of these there are many available.

It must be pointed out that people who have not been in the habit of eating foods containing a good deal of bran should partake of these sparingly at first, otherwise digestive disorders may result.

The presence of bran, desirable as it is for stimulating intestinal action, affects the cooking of whole grains and the meal prepared from them.

Wholemeal is the flour obtained by grinding the entire wheat grain. A variety of

grades can be obtained. The finest can be used for making sponge cakes, whereas the coarsest is suitable for bread and parkin. The medium grades can be used for scones, cakes, puddings, short crust pastry and bread-making, in fact, for any household dish except flaky, puff and rough puff pastries and soufflés.

The stone ground wholemeal has the sweetest flavour, but for economical reasons most of the wholemeal on the market is produced by the machinery existing for the milling of white flour.

Owing to the presence of the bran and to the correspondingly low percentage of starch compared with white flour, some difficulty is often experienced in handling wholemeal mixtures. As a rule more liquid is absorbed than when white flour is used and more thorough mixing is required. Longer baking is necessary, but care must be taken not to overbake otherwise a bitter flavour develops.

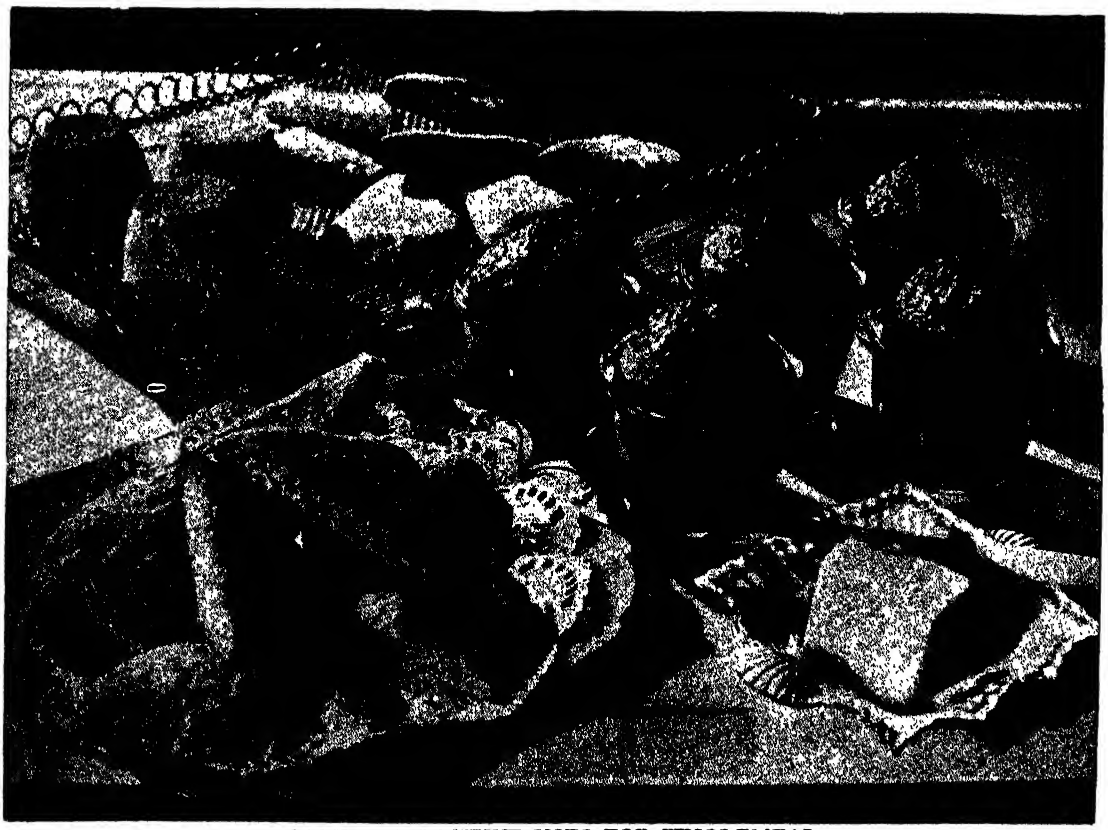
It is desirable that half the fat used should be lard when making pastry, scones and cakes, as this keeps them reasonably moist for a longer period than if margarine alone be used.

Oatmeal does not receive the attention it deserves. Although its deficiency in gluten makes it more difficult to use than wholemeal, yet it can be utilised for porridge, biscuits, gingerbreads and oatcakes.

Prepared bran is now available at most stores and it can be added to scones, bread and cakes; it is invaluable as an aid to regular intestinal activity.

Mention must be made of the rye breads and biscuits now on sale. These are excellent. Unfortunately rye flour is not easily obtainable in this country.

Whole rice and whole barley, *i.e.*, the "brown" grains from which the outer shell or coating has not been removed, can be obtained from a few of the larger stores.



SOME ATTRACTIVE USES FOR WHOLEMEAL

Scones, biscuits, cakes and puddings, which can be served with butter or with jam.

These may be used with advantage for milk puddings in place of the purely starchy grains such as sago, tapioca and white rice. The same proportions and ingredients should be used, but the grains should be washed and soaked overnight, otherwise they take a long time to cook. The flavour is delicious, and as with all whole grain preparations the milled grain appears insipid by comparison.

The recipes given below show typical ways in which whole grain dishes can be introduced into the diet :—

OATMEAL PORRIDGE.

2 oz. medium oatmeal
1 pint boiling water
¼ teaspoonful salt

Sprinkle the oatmeal into the boiling water, stirring well. Bring to the boil, add the salt, stir and boil for ten minutes. Continue cooking in a double cooker until ready.

WHOLEMEAL PUDDING.

4 oz. wholemeal	1 teaspoonful orange rind
2 oz. sugar	2 tablespoonsful marmalade
2 oz. butter	Pinch of salt
1 egg	1 teaspoonful baking powder
1 gill milk	

Sieve the flour, salt and baking powder, rub the butter into the flour, add the sugar and orange rind. Beat the egg, add it and the milk to the dry ingredients. Beat thoroughly. Grease a basin, put the marmalade at the bottom, pour in the mixture, cover with greased paper and steam for two hours.

WHOLE RICE PUDDING.

2 oz. whole brown rice
1 dessertspoonful golden syrup
Pinch of salt
1 pint of milk
1 oz. butter

Wash the rice, soak it in the milk overnight in a greased pie-dish. Stir in the syrup and salt. Put the butter on the top. Bake at 340°F. for 2½ hours. Stir occasionally during the first hour.

WHEATEN BISCUITS.

5 oz. medium wholemeal
3 oz. rolled wheat
½ teaspoonful bicarbonate of soda
1 teaspoonful cream of tartar
Pinch of salt
1 oz. sugar
3 oz. butter
½ an egg and milk to mix

Sieve the bicarbonate of soda, cream of tartar, salt and wholemeal, and add the bran which rests on the top of the sieve. Stir in the rolled wheat and sugar, and rub in the butter. Mix to a stiff paste with the egg and milk. Roll out very thinly on a floured board. Cut into biscuits with a fancy cutter and place on a greased tin slightly apart. Bake at 330°F. until pale brown and firm.

WHOLEMEAL FRUIT CAKE.

¾ lb. fine or medium wholemeal	1 oz. mixed peel
½ lb. butter	2-3 eggs
½ lb. castor sugar	1 teaspoonful baking powder
¾ lb. sultanas	Milk to mix
3 oz. currants	Pinch of salt

Sieve the wholemeal, salt and baking powder together. Add the bran from the top of the sieve. Cream the fat and sugar ; add the eggs one at a time, together with a tablespoonful of the sieved ingredients. Beat well after each addition. Add the remainder of the sieved ingredients together with sufficient milk to give a soft consistency. Stir in the cleaned fruit and put the mixture into a lined cake tin and bake at 365°F. for 1½ hours or until the cake is well risen, brown and firm.

BRAN CAKES.

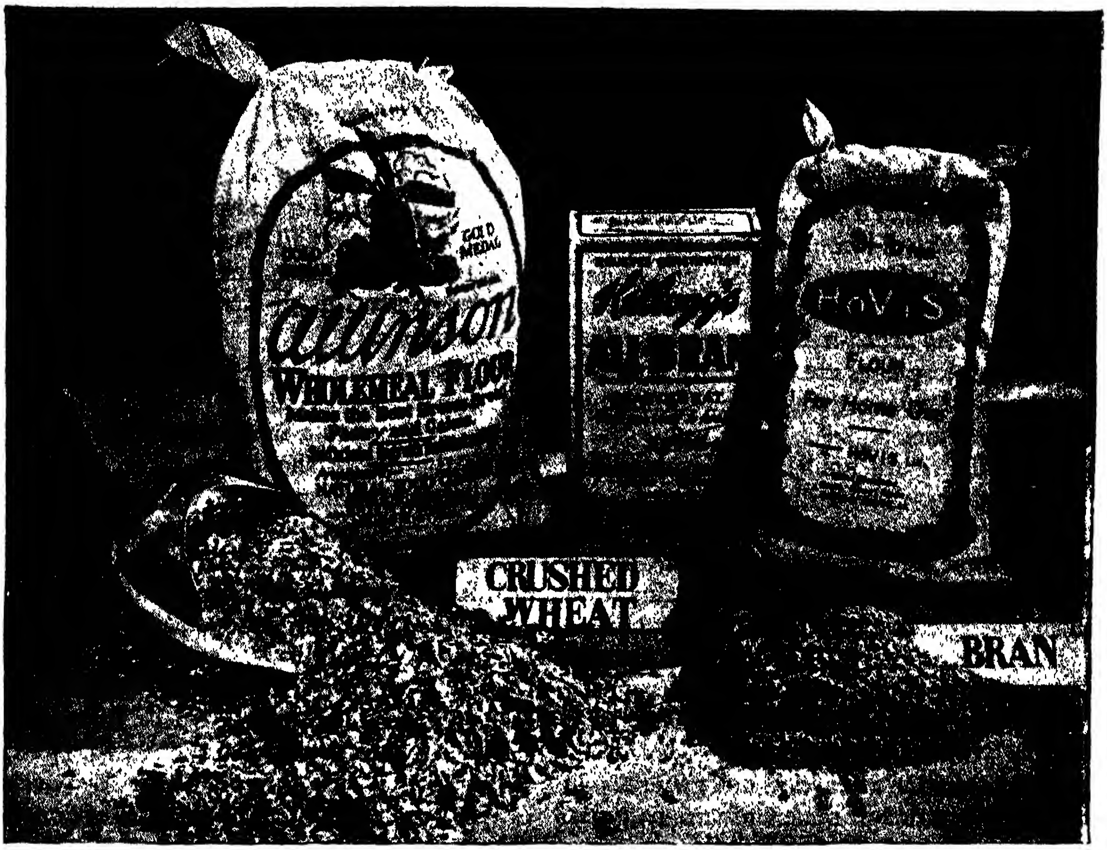
7 oz. wholemeal	3 oz. butter
2 oz. bran	1½ teaspoonsful baking powder
1 egg	
4 oz. sultanas	Pinch of salt
2 oz. sugar	Milk

Sieve the flour, salt and baking powder. Rub the butter into the dry ingredients. Add the bran, sugar and sultanas. Beat the egg and add it together with sufficient milk to mix to a fairly soft consistency. Beat well. Put into small buttered cake tins and bake at 400°F. until firm and brown. This will take about 20 minutes.

BREAD AND BREAD-MAKING

By JOHN CAMPBELL, Ph.D.

THE chief bread-making cereals are, in order of importance, wheat, rye and maize. Wheat is pre-eminently suitable for the production of bread on account of the high percentage of gluten which its flour products form when mixed with water.



Courtesy] A VARIETY OF WHEAT PRODUCTS [" Good Housekeeping "
Different methods of using the outer part of the wheat grain which is removed in the making of white flour.

Gluten is a mixture of two proteins, gliadin and glutenin. When these are in the correct proportions, as they are in wheat, and mixed with water in the presence of the cereal mineral matter, a stable elastic tenacious dough is formed which holds the gas produced by the yeast fermentation, the dough slowly rising during the action. In wheat the proportion is approximately 1 per cent. glutenin to 2.5-3.5 per cent. of gliadin. The other cereals are lacking in these proteins and so do not form doughs of the same character as those made from wheaten flour. Subsequently by further expansion under oven heat, the gas thoroughly permeates the dough forming the vesiculated texture of the loaf.

The flours used in bread-making come generally under the following classification :—

(1) Patent Flours, sometimes called "hard flours," are milled from hard wheat, and represent the endosperm of the grain. They contain a high percentage of gluten and are devoid of the germ, bran and softening ferments. These flours give very stable doughs and produce bold, white loaves of very even and light texture. Patent flours represent about 70 per cent. of the wheat grain.

(2) Soft Flours produced from the soft wheats giving doughs of less stability. The loaves are not so bold, or the texture so light and even as in bread made from patent flour. They are appreciably darker in colour, but the flavour is fuller.

(3) Intermediate Flours are not so highly milled as the foregoing and contain more of the wheat grain in the form of the inner layers of the bran and, sometimes, the germ.

The bread yielded by these flours is of a somewhat close texture and darker than that produced from "patents," but of a higher nutritive value.

(4) WHOLEMEALS, representing from 95-100 per cent. of the whole grain. These meals contain the bran and the germ, and softening ferments derived from these structures. Wholemeal doughs are unstable, the gluten gradually softening under the action of the ferments as the bread-making proceeds. The dough therefore does not efficiently hold the gas, and the loaves are small, and the texture close and dense.

Single flours are not exclusively used for bread-making. The miller or baker blends different flours to secure different properties, some for strength and colour, others for stability and flavour, the mixing and sifting being carried out in special machines.

The Dough.

In modern baking the dough is usually formed in one operation ("straight doughs") by mixing the blended flour with water, salt and yeast.

This operation is carried out generally in power-driven dough mixers of various types. The water is brought to a suitable temperature, accuracy being secured by the use of special attemperating tanks. The modern restriction of the working hours of operative bakers and the abolition of night baking has necessitated the reduction of the doughing period, and for this reason Brewer's yeast has fallen into disuse on account of its slow fermentative action. For similar reasons the older preliminary processes, prior to the making of the actual dough, of making liquid ferments, with potatoes or rye and yeast, and soft "sponges" made with part of the flour, for the purpose of promoting yeast growth and developing flavour have been generally abandoned in favour of the quicker process of straight doughs.

Compressed distillers' yeast is now generally employed, from 1 lb. to 1½ lbs. being allowed per sack of 280 lbs. of flour. It is very rapid and certain in its action bringing the dough along in from 3 to 5 hours. Sometimes the baker adds malt flour or extract or some other form of sugar to stimulate the action of the yeast. From 3 to 3½ lbs. of salt are allowed per sack. After thorough mixing the dough is transferred to troughs to ferment and ripen.

This process is essentially a yeast fermentation, whereby the natural sugar of the flour, and that added or formed during the doughing period, is split up into alcohol and carbonic acid gas (CO_2) and small quantities of certain by-products including acids which help to confer the characteristic flavour to leavened bread.

The gas is held by the tenacious gluten of the dough, which slowly rises under its expansive force to a maximum volume near which the dough should be taken. Should the dough be allowed to stand beyond this point, much of the gas escapes and the dough falls back and consequently produces loaves of inferior volume and texture.

Dividing, Scaling and Moulding.

The dough is now ready for division and scaling and moulding, carried out in all modern bakeries by machinery. The half-quartern 2-lb. loaves are usually weighed out at 2 lb. 1½ oz. to allow for the loss of water by oven evaporation. The weighed portions of dough are now moulded into the shape required, either coburg, cottage or long loaves ready for the oven.

A fair proportion of loaves are baked in tins, especially the proprietary brands of bread, as designs or names are readily impressed on the loaves by appropriate tin stamping. Wholemeal specially is usually baked in tins. Tin bread differs mainly from ordinary bread in that the formation of crisp crust is limited to the exposed top.

Oven Baking.

During recent years, great progress has been made in the construction of ovens, securing among other advantages even heating, economy in firing and baking, and greater facilities in working, replacing the older "peel" oven.

Steam has largely replaced coal and coke for heating purposes, and the draw-plate form obviates the necessity of loading and emptying the loaves singly by the long-handled "peel." This type of oven carries a movable metal plate sliding over the floor of the oven. The plate is drawn right out on

Courtesy] [" Good Housekeeping "

HOW TO MAKE BREAD AT HOME

Above—Mixing the yeast with *tepid* water before adding it to the flour. *Below*—Kneading the dough, which is afterwards put to rise in a warm place before baking.

wheeled supports for the purpose of placing the loaves. When loaded it is pushed back with its full complement of loaves. The chief advantages are economy in time and uniform baking of each loaf. The temperature of the oven, measured by pyrometers, varies from 450° to 500° F.

During the baking process bread undergoes profound changes :—

(*a*) Water is evaporated.

(*b*) The alcohol is largely driven off.

(*c*) The starch is gelatinised in the crumb.

(*d*) Proteins are coagulated.

(*e*) Part of the starch in the crust is dextrinised.

(*f*) Distinct flavours are developed.

The temperature of the central crumb of the loaf is probably always below the boiling point. The outer layer of the crust reaches the dextrinisation point 200°-210° Centigrade and in some places may be partially carbonised.

In modern machine bakeries contact of the bread with the hands is negligible, and the practice of wrapping loaves as soon as is practicable after baking is increasing. Wrapping bread is a distinct advantage from the health standpoint, as it entirely eliminates the danger of contamination from the air or by handling.

On being kept, bread gradually becomes stale, the change being accompanied by the loss of water. The cause of staleness in bread is not yet properly understood. It is not merely due to the loss of moisture, though that may be the predominating factor, for on being carefully re-heated bread takes on again the characters of new bread. Obscure physical conditions in the intimate combination of the gluten constituents and the starch granules are probably contributory causes.

Staleness.

WHITE WHEATEN BREAD

This form of bread forms the staple food of many countries, and it is from that standpoint that its dietetic value must be studied. Good quality white bread made from "patent" flour has the following average composition :—

	White Bread —Average Analysis* per cent.
Water	37.21
Proteins (Flesh-formers)	6.65
Fat (Fuel food)	
Carbohydrates (Fuel foods). Starch Dextrin, Sugar	54.02
Cellulose (Roughage)	.32
Ash (Teeth and Bone-forming)	.92
	100.00
Vitamins	Trace
Lipoids (organically combined phosphates)	Trace

Calories—1852 per lb. of dry solids.

*Campbell.

Compared with a standard diet for a man of average weight and doing an average day's work, the following results are arrived at :—

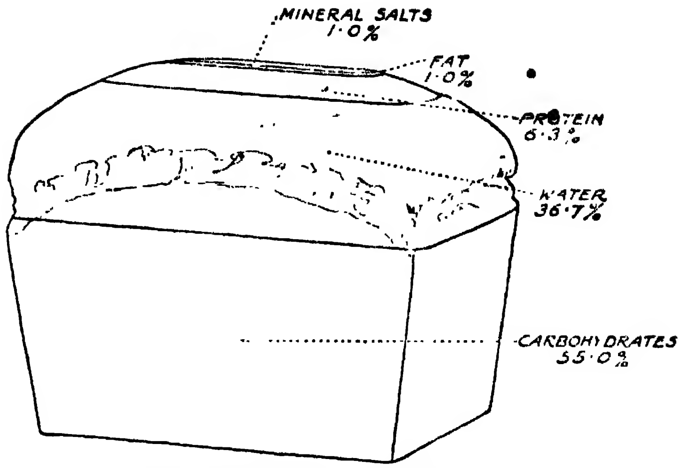
	Standard diet (dry)	Calories	White Bread	Calories
Carbohydrate	14.5 oz.	1682	19.4 oz.	2250
Protein ..	4.5 oz.	522	2.3 oz.	269
Fat ..	3.0 oz.	790	0.3 oz.	79
	22.0 oz.	2994	22.0 oz.	2598

The considerable deficiency of calories in the weight of bread is mainly due to the small proportion of fat present. These figures show that white bread as a staple food is deficient in protein and fat and gives a surplus of carbohydrates. The deficiency of fat is not important as it is the universal custom to eat bread with butter, margarine or dripping.

The ratio of protein carbohydrate in the standard diet is as 1 : 3.22, but in white it is as 1 : 6.71, so that as a staple food it is badly balanced in those proximate principles. The wheaten proteins are not of a very high quality as flesh-formers, the amino-acid derivatives being badly balanced relative to the constitution of human muscle. For this reason not only should white bread as a staple food be supplemented with foods rich in protein, but the latter should preferably be drawn from the animal kingdom in the form of butcher's meat, fish, milk and milk products and eggs. From the vegetable kingdom the pulses yield the best supplementary proteins.

White bread is also deficient in the organically combined phosphates (lipoids)

and should be supplemented with eggs and fish roe, these foods yielding the deficient principles. The mineral phosphates are also deficient and are best made good from milk and milk products.



THE COMPOSITION OF WHOLEMEAL BREAD
A loaf of wholemeal bread showing the percentage composition. The protein and vitamin content is higher and the carbohydrate lower than in white bread.

White bread contains only traces of vitamins—a most serious drawback in a staple food. The absence of fat-soluble vitamin A (growth factor) and vitamin D (anti-rachitic factor) are easily made good by butter and other milk products, dripping, the fat of butcher's meat, the fatty fish, and eggs; and vitamin C by fruit and fresh vegetables. But vitamin B (growth and anti-neuritic factor) is not so easily supplied from other foods, being largely found in the germ and bran of wheat—the very constituents rejected in the milling of white flour, and there is a consensus of opinion among dietitians that where white bread forms the staple food there exists probably a permanent deficiency of vitamin B, as the foods containing it in notable quantities derived from the germ, bran of wheat and other cereals are not numerous and generally expensive, and are not consumed in sufficient quantities to make good the deficiency. The supplementary foods are mainly eggs (the yolk), liver, brain, sweetbread, fish roe, nuts and the pulses and proprietary preparations of yeast (dried and extracts) wheat and germ. Vegetables generally also contain varying quantities of vitamin B.

White bread is very thoroughly digested. On account of the absence of roughage and the superfine texture there is very little waste. On the other hand the absence of roughage combined with the deficiency of vitamin B is favourable to constipation, a condition which is disastrous to the maintenance of good health.

White bread regarded merely as a ration forming a small part of the tally that makes up a mixed diet of the well-to-do is an economical and valuable digestible food of high caloric value. But as the staple food of children and the industrial and agricultural population it is deficient in vital and essential elements. The dietetic and vitaminic improvement of our daily bread thus becomes a matter of pressing national importance.

WHOLEMEAL BREAD

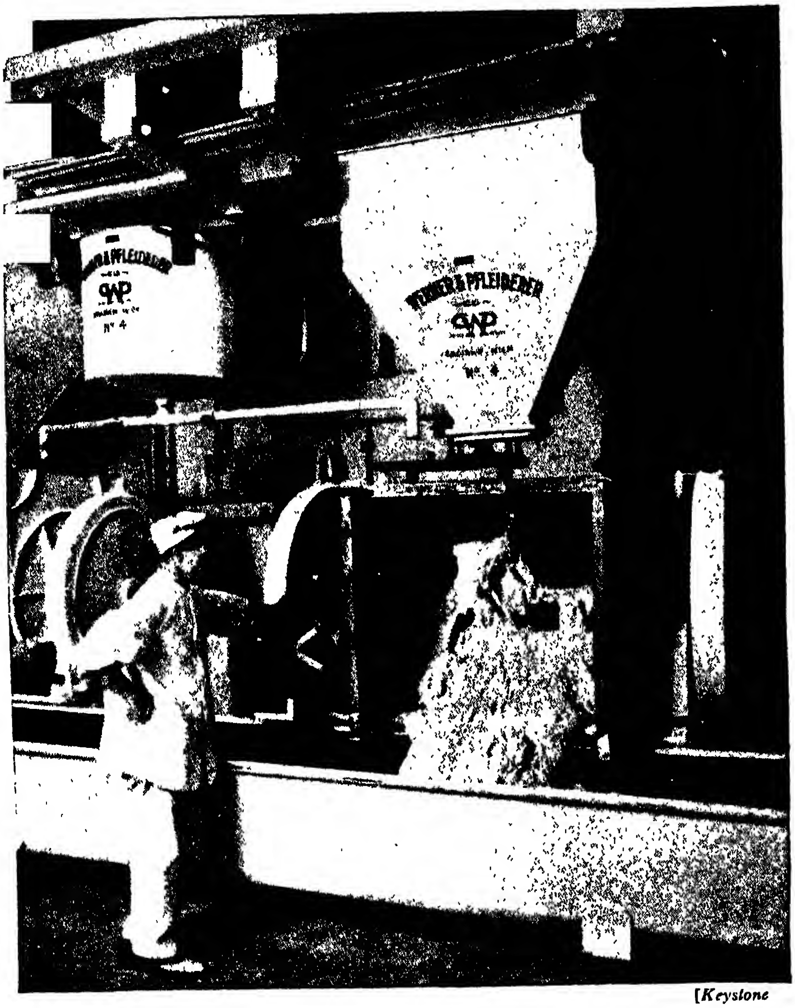
Wholemeal bread is only rightly so named when it is made from meal representing 95-100 per cent. of the wheat grain, containing the germ and bran.

	Wholemeal Bread —Average Analysis per cent.
Moisture ..	40.0
Fat	.. 1.2
Protein ..	10.2
Carbohydrates	45.5
Cellulose of Fibre	1.8
Ash	1.3

Lipoids	Present
Vitamins	Full cereal content

Calories—1803 per pound of dry solids.

Compared with white bread, wholemeal bread contains more protein, fat salts and roughage, and it has the full cereal content of lipoids and vitamins A, B, D, derived from the germ and bran. The ratio of protein to carbohydrate is nearer to that of the standard diet, but the total caloric value is lower.



[*Keystone*

A MODERN BAKERY

Mixing large quantities of dough by machinery in a modern bakery.

normal motion through the intestines, and a full complement of cereal lipoids and vitamins, derived from the germ and bran.

When wholemeal forms the staple food of the diet less of the supplementary protein and vitaminic foods are needed, and there is less danger of ill health and disease arising from a deficiency of vitamin B. The ash of wholemeal contains a higher proportion of mineral phosphates. Though much of this phosphatic material remains locked up in the excreted bran, still there is a greater assimilation of the salts and so wholemeal is specially valuable for growing children, providing the calcium phosphates, which in conjuntion with the fat soluble vitamin D– derived from cod-liver oil, milk, milk fat products, beef fat and fatty fish –ensure the formation of sound bone and teeth, and prevents the incidence of rickets.

Wholemeal bread compared with the average normal diet gives the following figures :—

	Standard diet (dry)	Calories	Wholemeal	Calories
Carbohydrates	14.5 oz.	1682	17.80 oz.	2065
Protein ..	4.5 oz.	522	3.75 oz.	435
Fat	3.0 oz.	790	.45 oz.	52
	22.0	2994	22.00	2552

This comparison shows clearly that wholemeal bread is a better-balanced staple food than white bread, though there is still a deficiency of protein (.75 oz.) and fat (2.45 oz.), and a surplus of carbohydrate (3.3 oz.)

The wholemeal in addition contains more roughage acting as ballast, stimulating

There is great divergence of opinion as to whether it is a dietetic advantage to include the whole bran in bread. It cannot be denied that in many persons and often in children the bran may unduly irritate the intestinal tract, probably due to individual idiosyncrasy, on the other hand, the dietetic experience of those native races who depend on cereals for their staple food is definitely in favour of the use of the entire grain. When the available data are weighed in the light of dietetic experience there cannot be much doubt that wholemeal is superior to white bread in all essential qualities as a staple food.

Wholemeal bread is not so easily or so thoroughly digested as pure white bread.

The proportion of excreted waste is higher, and according to many authorities its ingestion increases slightly the unassimilated percentages of other food. Those who prefer wholemeal bread should obtain a guarantee from the baker that it is made from a genuine wheaten wholemeal. Much of the so-called wholemeal bread contains only a very small proportion, if any, of the germ and often the bread is merely a mixture of ordinary white flour with added bran.

SPECIAL BREADS

Germ Bread. The germ is the most nutritious part of the wheat grain and contains the cereal vitamins and lipoids (see " Cereals and their Products "). Having a high protein and fat content, its inclusion in flours used for bread-making is a great advantage. In the roller milling of white flour, the raw germ is eliminated because it contains enzymes that cause the flour to ferment and form certain toxins that are undesirable. By suitable thermal treatment, however, these ferments and toxins may be rendered inert and then the germ can be mixed with white flour without deterioration of keeping qualities.

In the Hovis process, for example, the germ is detoxicated and rendered incapable of producing fermentation without the destruction of the precious vitamins. Hovis may be regarded as a standard germ bread, consisting of white flour with the addition of 25 per cent. of detoxicated wheat germ.

From the nutritive and dietetic standpoint germ bread is far superior to white bread, making good the deficiencies of the latter in protein, vitamin and the organically combined phosphates. These advantages are exemplified in the following table, Hovis giving a correct balance of carbohydrate and protein.

[Keystone

A HYGIENIC LOAF-WRAPPING PLANT

In many modern bakeries almost the whole process of bread-making is performed by machinery, and the finished loaves are wrapped in paper without coming in contact with the worker's hands.

	Standard diet 22 ozs. of dry solids	White Bread 22 ozs. of dry solids	Germ (Hovis) Bread 22 ozs. of dry solids
	Yield	Yield	Yield
Carbohydrate	14.5 ozs.	19.4 ozs.	16 ozs.
Protein	4.5 „	2.3 „	4 „
Vitamins A B.D.E	A full complement	Absent	A full complement
Lipoids	A full complement	Absent	A full complement

The vitamins present in the Hovis Germ Bread are :

(1) The fat-soluble vitamins A and D. They are growth-promoting and anti-rachite.

(2) Water-soluble vitamin B, associated with growth and the nutrition of the nervous system.

(3) Vitamin E having factors affecting the functions of lactation and reproduction.

The lipoids present in germ bread are especially valuable as the special sources of the phosphorus needed by the brain and spinal cord. Though generally dearer than white bread, germ bread is just as economical, as less weight gives more perfect nutrition.

Starch-Reduced Bread

It has already been pointed out that the defects of white bread as a staple food (viz. : the deficiency of protein and the surplus of starch) may be made good by the addition of other food substances having an opposite composition, *e.g.*, the germ of wheat, milk, soyolk (detoxicated soya bean flour), etc. But obviously the elimination of the surplus starch from white flour with the addition of a neutral fat will effect the same result, and this is the principle governing the production of all the Energen health foods. By the use of special machinery the Energen process eliminate the surplus starch from the dough without deterioration of the other organic constituents, and thus raises the percentage of protein in the residium, and its ratio to the carbohydrate content.

The changes which this process effects are well exemplified by the following analyses :

	White Bread (dry solids)	Energen Bread (dry solids)
Protein	10.6	39.7
Fat	1.4	6.3
Fibre	.5	.1
Carbohydrates ..	86.0	49.7

These figures show an increase of nearly 300 per cent, in the protein and a decrease of over 40 per cent. in the starch.

This starch-reduced bread is standardised in composition—a great advantage in the formulation of dietaries and, in addition, for ordinary table use, it is specially valuable in weight reduction and many forms of carbohydrate dyspepsia. The tissue-building value is nearly four times that of ordinary white bread, whilst the fattening properties due to surplus starch are entirely absent.

Incidentally it is extensively used in diabetic dietary when a bread is required having a high protein content with a low fixed ratio of starch.

Malted Bread.

Malt is the name given to a germinated cereal in which the growth is arrested at an early stage. Barley is almost exclusively used for this purpose. Malt extract is the product obtained by extracting the crushed malt with hot water and concentrating *in vacuo* to the consistency of treacle.

During the germination process various ferments are formed in the germ, which break down the starch and proteins of the endosperm into assimilable foods for the growing plant until such time as it is capable of drawing sustenance from the air and soil.

The most important of these ferments from the bread-making standpoint is diastase, which converts insoluble starch into assimilable malt sugar and dextrin, but ferments that soften the gluten are also present. Malt thus contains considerable quantities of already formed sugar and also actual diastase, which is capable under suitable conditions of producing further saccharine matter, from the starch of the flour. Malt is not generally used in the actual form of the crushed grain, bakers finding it more convenient to employ a malt extract. Usually the malt extract is added at the doughing stage and accomplishes two purposes :—

(1) It supplies fermentable sugar immediately available for yeast fermentation.

(2) The diastase present under favourable conditions is continuously producing additional quantities of sugar from flour starch.

The low temperature of the dough (80°-94° F.) and its stiff physical condition, however, militate against extended action and under ordinary conditions the net germ of maltose is very small, the baker using it chiefly as a quickener of fermentation, shortening the process of doughing.

It is practicable, however, by adopting special methods, to effect a considerable conversion of starch, and the late Mr. Montgomerie, of Partick, was the pioneer in the scientific use of malt extract in bread-making. His method, now known as the Bermaline process, effects a notable reduction in the starch content of bread with a corresponding increase in the soluble constituents.

The following table gives the comparative percentages in white bread and bread malted by the Bermaline process:—

Dry Solids	White Bread	Bermaline Process
Total Soluble Extract	15.14	35.30
Starch ..	71.58	48.49
Dextrin and Sugar	14.02	33.01

[Herbert Felton

WINNOWING CORN IN EGYPT
The wooden shovel still in use to-day was depicted on tombs 5000 years ago.

Malted bread is distinctly moister, is more digestible, and keeps eatable longer than ordinary bread, and possesses a characteristic sweet flavour. On the other hand, highly malted bread is soft in texture and does not exhibit the fine vesiculation of ordinary bread, and therefore does not cut so well in slices. It contains a lower starch content and on this account is specially useful to those who do not well tolerate that food stuff.

Milk Bread is prepared by the substitution of separated or whole milk for part of the water used in making the dough. This addition enhances considerably the nutritive value of the bread, increasing the protein and phosphatic mineral content. It is particularly beneficial in a childhood dietary.

Toast.—In the preparation of toast, water is driven off, starch is converted into the more digestible form of dextrin, and partly carbonised. Toast presents bread in a more digestible and concentrated form, and the crispness of the slice facilitates and favours thorough mastication. It is distinctly more digestible than soft bread.

Unleavened Bread. Unleavened bread, commonly known as aerated bread, is carbonated artificially by forcing water impregnated with carbon dioxide (CO_2) into the dough, the pressure being maintained in the mixers during the doughing process. There is no fermentative process and the finished dough merely represents aerated flour and water. Aerated bread is characterised by an even texture, but it lacks the characteristic flavour of

that produced by yeast fermentation. To improve the flavour, the modern practice is to use in conjunction with the carbonated water a weak wort made by mashing part of the flour with malt. This, however, merely sweetens the bread and does not supply the secondary products of yeast fermentation which help to confer the characteristic flavour to ordinary bread. Aerated bread has practically the same nutritive and digestible value as ordinary fermented bread, and the process is particularly adapted to the production of whole-meal, giving loaves of more even and firm texture than those made by the fermentation method.

Artificial aeration of dough may be carried out by the use of certain chemicals, which produce CO_2 by interaction in the moist dough or under the heat of the oven, and leave harmless residues. These are used by bakers and generally in home baking.

Crisp Breads.

In Sweden rye bread is made in the form of well-baked oblong thin crisps, and does not develop the crude acid flavour of the ordinary rye loaf. Swedish rye crisp bread is rapidly growing in favour in England, and many firms now regularly import supplies for the English market. In this form rye bread constitutes a welcome and digestible alternative to our white bread, the crisp character of the slices favouring complete mastication. This bread is particularly useful where the natural functions of the bowel need stimulation.

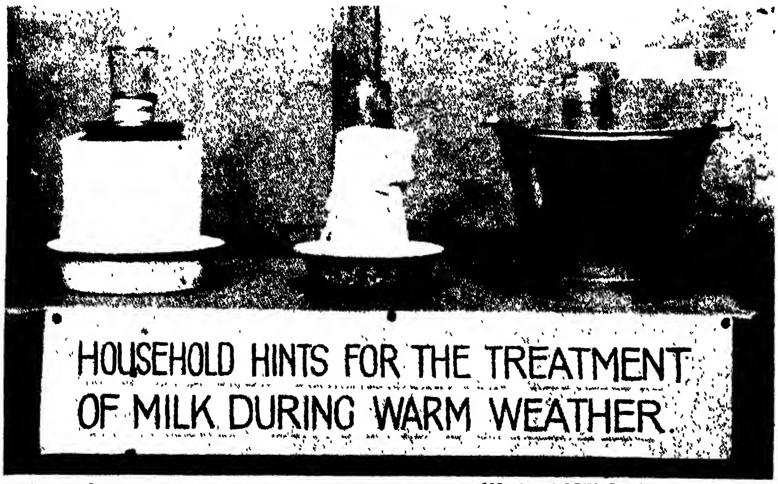
Recently crisp whole wheaten bread under the name of Vita-Weat has been successfully produced and marketed, the special features being preliminary thermal processes to soften the bran and gelatinise and dextrinise the starch. These crisps are most digestible and make a very welcome change from ordinary white or wholemeal bread.

Modern bread-making is generally carried out under sound hygienic conditions, by machinery. The underground hand bakeries are fast disappearing, being replaced by well-ventilated premises with perfect sanitation equipped with the latest types of ovens and machines. The trade is no longer content to work by obsolete rule of thumb methods. Most bakers nowadays are well versed in the scientific principles which underlie their industry, and bread-making has been raised to a high level of technical efficiency.

DAIRY PRODUCTS IN THE MENU

By ELIZABETH EDWARDS ("Good Housekeeping" Institute), First-class Diplomas in Cookery, etc.; Certificate in Household and Social Science, King's College for Women.

UNDOUBTEDLY many people regard the liberal use of butter, cream, eggs and milk as an unnecessary extravagance, and cheese dishes are rarely attempted owing to lack of knowledge in preparing them suitably. A brief description of the respective food values of these dairy products, followed by suggestions for utilising them fully in the diet will show them to be essentially economical, both from the monetary and nutritive standpoint.



Courtesy] [National Milk Publicity Council

Milk is the most readily available of all dairy products, and it must be regarded as a necessity, not a luxury, in all diets. The modern hygienic methods of producing and handling milk

THE VALUE OF MILK IN THE DIET
One and a half pints of milk are equal in nutritive value to the other commodities shown.

render it, along with eggs cheese and butter, among the purest and most natural foods at our disposal.

Primarily, milk should be taken raw as a beverage throughout life, half to one pint can be allowed per day per person for this purpose alone. Emphasis must be laid on its special suitability for children of all ages. Milk combined with water, barley water or soda water, will be found to be more readily digested by those who are unable to take it undiluted. Biscuit, cake or bread should always accompany a drink of milk as these break up the curd formed by the milk on entering the stomach and thus aid the digestion.

Milk

It is not enough, however, merely to regard milk as a beverage. From half to one pint per head per day will be required for cooking purposes. It is stated that one 1½ pints of milk are equal in nutritive quality to 4-4½ eggs or 7½ oz. of mutton, or 10 oz. of cod, or 4 oz. of cheese. This holds good although milk contains on an average 88 per cent. of water. The prices of these foods compared with milk show unquestionably that milk is the cheapest source of animal protein. Add to this the fact that it contains all the constituents necessary to support life and that these are very readily digested and assimilated, the economy of milk as a food will be acknowledged, and a big milk bill justified. Mention should also be made of the invaluable salts of lime and phosphorus present, and the high vitamin content of raw milk.

In order to utilise milk fully in cooking, it should be combined with some starchy substance, such as bread, potatoes or rice. Owing to its neutral flavour it can be introduced into either sweet or savoury dishes. Porridge and soup can be made wholly or partly of milk. Milk puddings and shapes containing whole grains may also be introduced into the diet. Bread, scones, puddings of all kinds, and sauces should be mixed with milk. Junket is of course one of the most quickly made milk dishes. If a double pan be used for milk puddings it will be found that the amount of evaporation

during cooking is reduced considerably.

Skim milk when available may be used freely for dishes requiring milk. A small piece of butter added to each half-pint makes the food value equal to that of full milk. Butter milk and sour milk are more easily digested than fresh milk, and they have in addition a beneficial action on the bacterial content of the intestines. Both butter milk and sour milk can be used for mixing steamed puddings, cakes and scones.

Butter should be bought as lavishly as the budget allows. Although lard and margarine can be used for cooking, no other fat can replace butter altogether in the diet and it should be used unsparingly on bread, toast and scones. It is the most easily digested of all fats and its richness in vitamins renders it a particularly important item of the diet.

Cream is undoubtedly a luxury dairy product, and as it contains on the average about half as much fat as butter, its use can be determined by the housewife's purse. Real cream cheese and lactic cheeses can replace butter occasionally, but they must be regarded as expensive and dietetically non-essential fats.

Courtesy] [*National Institute of Dairying*

THE CARE OF THE MILK JUG

The milk jug should be filled to overflowing with boiling water for at least one minute, allowed to drain, and then covered with a saucer.

Cheese.

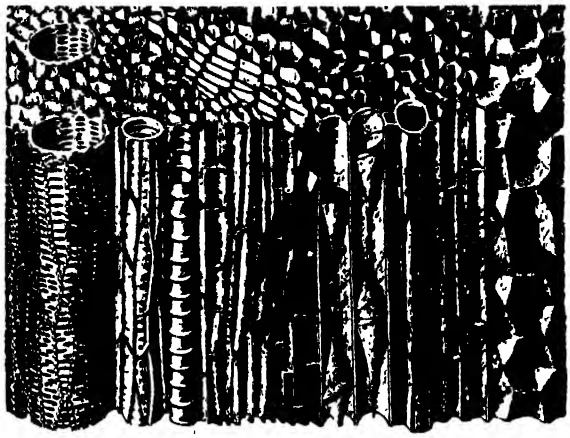
It is undeniably the case that cheese is not put to its fullest dietetic use in this country. This is largely due to ignorance concerning its preparation for the table. Undoubtedly many people find it hard to digest and this is because it is either swallowed in large pieces or eaten in too large quantities. The calorific value of a pound of cheese is equal to that of 3 lbs. of beef, and it is generally acknowledged that its general nutritive value is double that of an equal amount of meat. Here again a comparison of prices shows the true economy of substituting cheese dishes for meat dishes at regular intervals. Owing to the fact that the fat and protein are intimately bound up, thus retarding digestion, cheese should be grated, chewed small, or melted in order to break it into small pieces which can be reached by the digestive juices. Care must be taken, however, to avoid hardening the cheese by over-cooking, otherwise it becomes indigestible. A good cheese, such as American cheddar, contains, approximately, equal parts of fat, protein and water. Like milk, cheese requires to be combined with potatoes, rice or other starchy foods in order to make a dish of all round food value.

Grated cheese can be added to milk soups just before serving ; cheese sauce served with cauliflower, hard-boiled eggs, onions, boiled macaroni, mashed potatoes, are among a few of the many ways of serving cheese.

Eggs must be regarded as relatively more expensive sources of animal protein than milk and cheese. Like these, however, there is no appreciable loss of weight in cooking. Light boiling proves to be one of the most digestible ways in which an egg can be cooked. This also applies to lightly cooked custards. Combined with milk and a carbohydrate, such as rice, the food value is increased considerably. Custards,

puddings or cakes containing eggs need not be regarded as unduly extravagant when it is considered how many people the dish serves.

The plentiful use of dairy products in the diet is thus seen to be of vital importance to both children and adults. They are cheaper than meat, they can replace it, and they are more readily digested. No other foods contain such an " all round " food value, including as they do, in the case of milk and eggs particularly, important mineral salts and vitamins. The neutral flavour of milk and eggs renders them suitable for either sweet or savoury dishes. With the exception of milk their chief lack is carbohydrate, and when this cheap type of food is added, a dish complete in food values is produced.



YOUNG RAW VEGETABLE CELLS
A diagram, very highly magnified, showing the cell-structure of a young green vegetable—largely composed of cellulose, useful in our digestive processes.

THE USE OF RAW VEGETABLES

By ARNOLD LORAND, M.D. (Vienna), Physician at the Carlsbad Springs, Czechoslovakia.

IT has been shown by recent research that the ultra-violet rays of the sunshine are most essential for the formation of the vitamins. It will be safe to suppose that the more of these rays reach a plant, the richer will be its content in vitamins, and the more energy will be stored up in it. I would like to mention one fact that points in this direction—namely, that it has been ascertained that the vitamins are found in greatest amount in the outer layer of vegetables and fruit, thus, under the skin of potatoes and apples.

Need for Raw Food.

The influence of vitamins and certain nutrient salts, lime, potash, etc., upon the efficiency of our muscles, especially the heart muscle, is scientifically established, as also that those kinds of fruit and vegetables which contain much vitamins are at the same time rich in such salts. Unfortunately both vitamins and salts are lost to a large extent through cooking, and especially reckless cooking, employing much higher degrees of temperature than necessary.

If through cooking the nutritive value of the vegetables is lost, it would then, of course, be much better for our health to ingest these vegetables raw. The more so as it has been shown recently by experiments on rats how much better those grew and thrived that were fed on raw plants, and raw food in general.

No doubt we should thrive much better on a diet containing raw vegetables to a considerable amount. But the trouble is that the cellulose—the fibrous tissue—contained in them offers great resistance to our digestive juices; for we have not such a long intestine, nor do we possess special ferments, like the herbivorous animals, the rabbit, hare, etc., to split up the cellulose. Digestive disorders, especially great flatulency, would be the consequences of such a diet. But there is a way to avoid this if we follow the example that Nature gives us in the constitution and functioning of our stomach juice. We are protected through an acid contained in it—the hydrochloric acid—which serves as a powerful disinfector of the stomach and intestine. Where it is lacking, putrefaction is augmented and auto-intoxication arises. Such is the case in pernicious anæmia, and according to the researches of Seyderhelm of Gottingen, and also of Hurst, it is due to intestinal auto-intoxication; it is, indeed, the highest degree of such a condition.

[Topical

RAW FOOD ENTHUSIASTS

Dr. St. Louis Estes of New York City, a " raw food " specialist, with his wife and five children—all of whom have been fed entirely on a natural raw food diet.

But this acid has also other important functions. It helps the digestion of proteid food, and it also helps the digestion of food of coarse constitution—thus, of hard fibrous vegetables; a fact not yet known generally. It penetrates and macerates hard fibrous tissues. When we are eating salads, we simply, as by instinct, follow the example Nature gives us in the acid stomach juice, for we also add acids, such as vinegar, to it. It would be more beneficial if we added a sufficient amount of lemon juice, which is very rich also in vitamin content. Tomato salad prepared with lemon juice is the richest food in vitamins obtainable, especially as regards the anti-scorbutic vitamin.

Acid in the Digestion.

That acids are able powerfully to help the digestion of vegetables is best shown by the example of Sauerkraut. Pressed with heavy weights into kegs and salted, lactic acid fermentation, a powerful help against intestinal auto-intoxication, arises. Such white cabbage will, after a certain time, become very soft; and in the same way, also, cucumber should be put into water with enough salt that it may simply melt in the mouth, and thus may be quite easily digested.

Similarly other kinds of vegetables can be rendered easily digestible by adding acids such as vinegar, and still better lemon juice, to them. Only it will be necessary to expose them for a sufficiently long time to the action of these acids. For this reason it would be far better, I would suggest, to prepare salads not at the table, shortly before we eat them, but to dress them several, even many hours, before the meal, in order to allow these acids to penetrate and macerate the vegetables' tissue and thus, so to say, pre-digest them. The oil should only be added to the salads after the acids have been doing their work for several hours previously.

I would also recommend that salads be taken for preference at the beginning of the meal. It has been shown by physiological research that vinegar or lemon juice is apt to augment the flow of the gastric acid. As in many conditions, and especially in elderly people, this acid may be diminished and often lacking, taking salads at the beginning of the

meal may act as an appetiser, powerfully fighting indigestion, and also limiting, as I have found, intestinal putrefaction.

The digestion of such vegetables would be much facilitated if they were grated on a grater, and then exposed for a certain time to the action of the acids. With the addition of acids the different kinds of raw vegetables —carrots, turnips, celery, cabbage, etc.— can be rendered easily digestible, if they are finely grated. By sprinkling finely cut parsley, leeks, onions or radishes on them, they could be rendered more palatable and our appetite for them stimulated. The addition of a little salt will also act in this direction.

The palatability of such vegetables will also be promoted by mixing amongst them grated walnuts and almonds, and also cream, as advocated by Dr. Bircher-Benner in his excellent book on raw diet. He also gives, in this book, directions for the preparation of an excellent breakfast food. This is served under the name of Bircher-Mussli in all the dietetic restaurants of Switzerland. A level tablespoonful of rolled oats is soaked for 12 hours in 3 tablespoonfuls of water ; then the juice of half a lemon and a tablespoonful of condensed milk is added and well mixed. Then two clean apples, including skin, core and pips, are grated into it, with a tablespoonful of grated nuts or almonds, and mixed in well. I know from my own experience that it is delicious.

The taste and the nutritive value of such raw vegetable dishes can be much enhanced by mixing into their substance olive oil. It is the best vegetable fat there is, and superior to all fats of animal origin, except, perhaps, butter. But whereas butter may soon show fatty acids and get rancid, olive oil of good quality will keep in a cool place many months in perfect condition. For cooking purposes, also, this product of the sun-rays should be preferred, for the reason that it is far more easily digested than the fat of beef dripping—so much used in England—or of pork or mutton.

Uses of Olive Oil.

Only those fats can be easily digested which will melt at 37 degrees C.—the temperature of our body. But the melting point of the fat of pork, beef and mutton is considerably higher than that of the body. Olive oil is liquid, and the product of a southerly sun, rich in the ultra-violet rays which ripened it.

According to my own observation, dishes prepared with olive oil of fine quality are far less apt to cause acidity, heartburn, etc., than those prepared with butter and the other fats.

It also has laxative effects, and, together with a sufficient amount of raw vegetables, eaten daily, may prove a useful weapon in the fight against that common source of so many ailments—intestinal auto-intoxication.

THE HOME GARDEN

THE ALL-ROUND FOOD GARDEN

By WILFRID EVANS, F.R.H.S., Hon. Horticultural Adviser to the National Homecroft Association.

HOW can a man with a modest wage and a wife and children to support ever be in a position to command the essentials of true family health? The question raises thoughts of the numberless hordes of unskilled workers with their numerous dependents living amid a hopeless environment of bricks and asphalt, which fill the social reformer with despair.

But there is a road to health for all decent working people who are willing to enter it ; and *a fortiori* for all middle-class people who are similarly minded. It lies in the art of family-sustenance gardening. The state of science warrants the highest hopes if the art were developed to the utmost. It is by no means beyond possibility that, with his own hands and in his spare hours, a man could largely victual his household in the most satisfactory way, with a health diet of vegetables, fruits, eggs, honey and even partly with milk and meat.

The diagram on p. 1479 shows the layout of a garden about two-fifths of an acre in size,

equipped for the purpose. It will be understood in what follows that numbers and areas and sizes are not rigid, but are to be varied to suit individual circumstances.

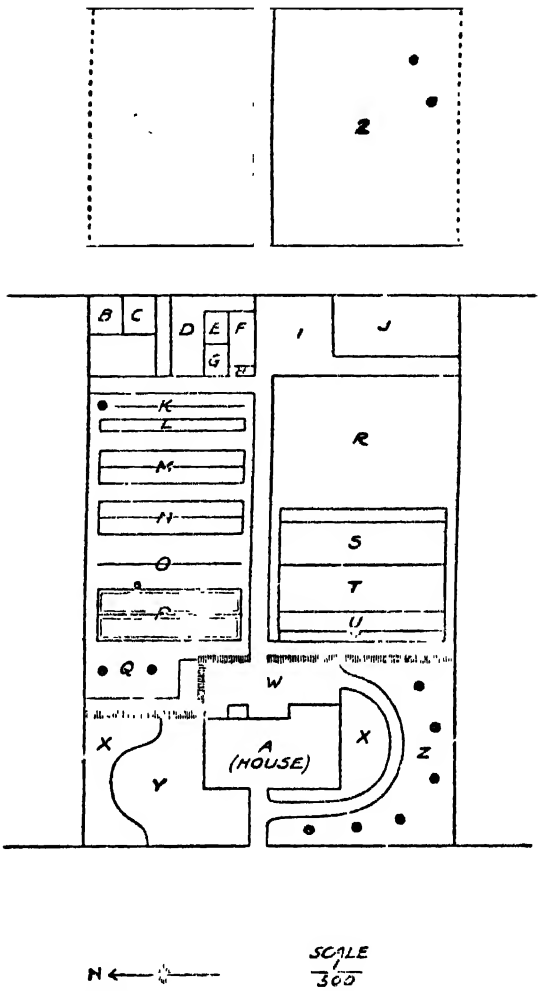
REFERENCES TO DIAGRAM

A. The House.
B and C. Pigstye and run. The occupant will be dealt with below; suffice it to say that the gardener may regard him both as a fruitful source of raw material and a depository for his surplus crops.
D. Storage for such raw material, and other imported manure.
E. Tool shed.
F. Fowl house.
G. Goat stable.
H. Rabbit hutch.
I. Yard for frame; this will be found extremely useful if only for a winter supply of lettuce, and cucumbers or marrows in summer.
J. Rhubarb bed and seakale.
K. Line of loganberries, varied if desired by Himalayan Berry which fruits later.
L. Asparagus bed.
M. Three rows of black currants.
N. Three rows of gooseberries.
O. Red (or/and white) currants.
P. Raspberries.
Q. This plot contains two apple-trees and will serve for seed and nursery beds as well. Apples and pears may be considered in conjunction; five more are indicated running along the north boundary, shortening the bush fruit as necessary; a further six are in plot Z; if stone fruit does well in the district some of the total thirteen might be plums. The front of the house and yard are separated from the produce garden proper by a trellis of wires on concrete uprights to which cordon trees are trained. Cordons give greater variety of sorts in a small area, are the easiest to prune and get at for spraying, etc., and all fruit produced is usually first-class.
R. This will contain the cabbage tribe, and will change occupancy with S. T. U. V. the following season. Both plots measure 27 ft. by 40 ft. and should accommodate 12 rows of 20 plants at 2 ft. by 2 ft. which gives 240 dinners with luck. The spring cabbage could be set at 1 ft. apart both ways, however, provided the alternate plants are cut as greens or "collards" before they heart up. These and winter broccoli and kale should be together, while cauliflower, early savoys and brussel sprouts, which will be cut earlier, can be at the other end
S. Early potatoes followed by autumn sown onions; July sown short horn carrots and globe beet.
T. Leeks and celery.
U. 3 rows of parsnips.
V. 2 rows of main crop carrots.
W is a yard.
X, since man does not live by vegetables alone, may be given over to hardy border perennial flowers.
Y is a grass plot for a seat and to beat the carpets on.
Z contains the fruit trees mentioned before; they will do better if it is cultivated, but it could be grass; in any case the immediate surround of the trees should be free of grass, flowers or crops.
1 is devoted to the greatest food value garden crop we have—main-crop potatoes—the first year, and is followed by the crops on 2 the second year. It is over six rods in extent; 6 cwt. of produce would be a very modest expectation and would roughly cover half the year at 28 lbs. consumption per week, which with the earlies also, should provide for four or five healthy appetites; if the crop is much heavier (and it should be) the pig and fowls will oblige if necessary.
2 can be left largely to personal taste, always provided (in this case) that the crops can be harvested by October. In the words of Robert Louis Stevenson, "There let the onion flourish . . . wine-scented and poetic soul of the capacious salad bowl"; also, "the bean, which gathered innocent and green, outflavours the belauded pea." It may be filled with these and most people will want plenty of green peas. It should be remembered that for the ground and attention they demand they are not the best food value crop, while broad beans do not require sticking, and the Dutch brown haricot bean can be stored through winter, to provide admirable breakfasts fried. It will be difficult to appease the cook if onions run short. One row of runner beans lasts a long time; French beans come earlier; marrows if they have not been already accommodated on the rubbish heap and manure heap, must not be omitted. Lettuce, spinach, radishes are easily accommodated as intercrops, here or in the enclosed part. Thyme and essential herbs should find a place near the kitchen door.
3 is the service roadway which encircles the Cheltenham Homecrofts dividing the fenced portion from the unfenced.
4 and 5 are grass strip and main roadway between the dwellings.

How to make the most of a given piece of ground in order to supply the needs of an average household; how to ensure that the powers that be in the kitchen are not overwhelmed one week with a surfeit of cauliflowers, nor in despair another week to find sufficient variety of fresh green food in late spring before the new crops come in; how, at the same time, to conform to cultural requirements in the matter of rotation of crops, and also keep an eye on the economical working of the land, so that casually set rows of winter greenstuff do not interfere with digging—this is no mean problem. In the matter of vegetables for an allotment garden, the problem has been solved and explicitly set forth for us both by the Ministry of Agriculture (Leaflet No. 315 and accompanying chart) where a ten-rod allotment is taken as model, and by the Royal Horticultural Society (*The Cropping of an Allotment or Small Kitchen Garden*—with coloured plan

and tables of food values of crops) where a twenty-rod allotment is shown. Any one interested in making the most of a vegetable garden by scientific and thoughtful layout and cropping would do well to obtain both of these—the first from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2., and the second from the Royal Horticultural Society, Vincent Square, Westminster, S.W.1., for a few pence each. In taking as model a larger piece of ground, namely the actual plan of one of the Cheltenham Homecrofts, it is obvious that fruit and other permanent crops, usually inadvisable to plant on an allotment, and consequently ignored in allotment literature, can here play a great part in supplying the needs of the household. In a typical Cheltenham Homecroft, the land beyond the roadway (roadway numbered 3 on diagram) is undivided from its neighbours, in order to allow of the communal tillage of the whole of this part of the holdings. This means that no winter-standing crops can be allowed on that part, which upsets admirable and well-tried rotations such as early potatoes, spring cabbage, followed by leeks and celery. The accommodation of sufficient winter greenstuff within the other part of the garden, without allowing brassicæ to follow brassicæ, is the chief difficulty.*

As the above diagram is drawn on a small scale, and the different plots only lettered, the reference list becomes necessary. Neither such accuracy nor such detail has been achieved as in the allotment plans referred to above, and the planter should refer to them; all the inter-cropping suggestions can be applied from them and much sound cultural information is given. They are, moreover, extremely useful in suggesting quantities of seeds required for given lengths, and in the choice of varieties. As to varieties of fruit trees and bushes, local wisdom is usually best



THE ALL ROUND FOOD GARDEN
The plan of a suggested food garden which is explained in detail on the opposite page.

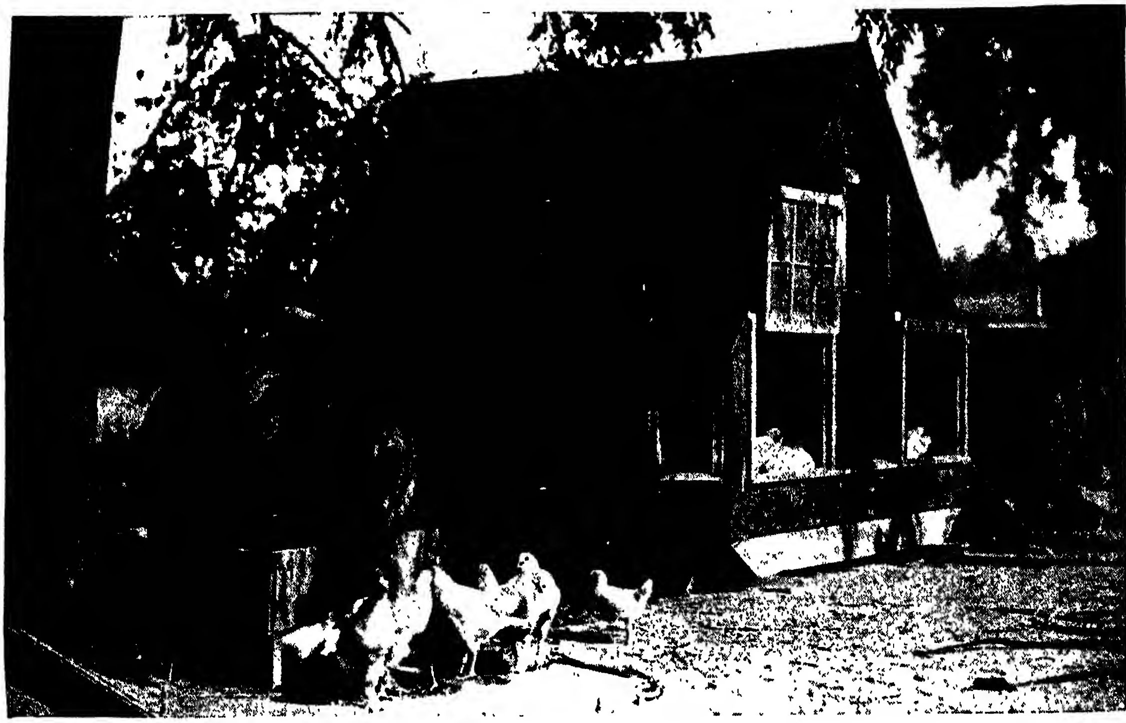
to follow, but very full information on this is also separately published by the Royal Horticultural Society.

THE FARM PRODUCTS

By E. T. BROWN, Sub-Editor of "The Smallholder."

NEW-LAID eggs and fresh, creamy milk all the year round and a succession of meats in great variety from New Year to Christmas, all produced within the confines of an average sized garden, is an alluring prospect. Yet it is a feasible project. Spring ducklings shortly after the turn of the year, the monotony broken when the six weeks'

* The point is mentioned lest experienced growers shy at sound routine methods being disturbed. Whether communally tilled or not, it is a great advantage to have as large a consecutive area as possible clear of crops for winter digging when there is more time to do it, and the great aid of the weathering of the rough turned soil is made use of.



[Keystone

THE "BACKYARDER'S" POULTRY RUN

Utilising a small space behind the house for the production of eggs and table birds.

old chickens make their appearance towards the end of April ; a supply of larger and still larger roasting fowls to carry on until the boiling fowls are ready at the beginning of August ; a few geese at Michaelmas, with turkeys for the festive season ; and home-produced rabbits and squabs at intervals throughout the year with a kid now and again for special occasions. An alluring prospect, a delightful dream, but a dream that is possible of fulfilment.

Home-produced table delicacies are always welcome, but the cost is sometimes prohibitive. Yet this need not be so. It is all a question of organisation and adoption of correct methods. Eggs, meat and milk can be produced by the amateur, of better quality, because fresher, and more cheaply than they can be purchased. Let us take these items in rotation and formulate a scheme which will give the desired results.

The purchase of 25 six months' old pullets and a like number of eighteen months' old hens in September will ensure a constant supply of new-laid eggs. Laying, normally begins about the middle of October. By the end of November the birds should be laying at 25 per cent. capacity ; that is, they should be producing a round dozen of eggs a day. The output would increase rapidly, so that when March arrives the yield should be in the neighbourhood of 80 per cent. or 40 eggs per day.

Eggs.

As the summer reaches its height the rate of production drops. The two-year-old birds are past their prime and must be discarded ; the pullets are preparing for their first moult. Eggs are scarce during August, September and October. Supplies can, however, be balanced by putting the surplus spring eggs into waterglass or lime water and holding them over until late summer and early autumn. Sufficient new-laids should still be available for boiling. Well preserved eggs are excellent for all other culinary purposes.

In this connection the breed, the house and method of management are of paramount

importance. A winter-laying breed is essential. One belonging to the heavy class is preferable, since flesh as well as eggs is a consideration. The White Wyandotte is the breed *par excellence* for the home food producer. This is not only the finest layer of all the heavy breeds; it possesses a peculiar characteristic in that the chickens from the age of six weeks until they reach maturity are always well fleshed.

An unlimited range is unnecessary. The layer can be housed throughout the year in a scratching shed 20 ft. by 14 ft. No open run need be provided, although where possible this is advantageous. A heavy yield of eggs can be ensured and health maintained under such conditions by proper management.

Spring Ducklings.

Large quantities of ducklings are not required for home consumption. By buying week-old birds at four week intervals from the middle of November no breeding stock need be maintained, and hatching, with its attendant worries, is obviated. Aylesbury ducklings are ready for killing at eight and nine weeks. Aylesbury-Pekin cross ducklings require two weeks longer to reach killing age. If an equal number of each be bought, a month's supply is obtained from each batch.

Housing need present no difficulty. A three-compartment semi-open-fronted shed, with a small run attached to one compartment only, is all that is required. Strict confinement is needed after the youngsters are four weeks old.

Chickens.

With chickens, intensively kept layers should not be used for breeding purposes. To breed also implies penning off a number of the two-year-olds apart and purchasing a male. But as one-half of the layers must be replaced annually a like number of pullets are required. These are best bought as day-old chickens at the beginning of March.

It can generally be taken that seven dozen chickens are needed to give twenty-five selected layers. One half of these will be cockerels and it is they that provide the spring chickens. From the time the cockerels are six weeks old they may be killed. The smallest birds make equally good eating with those which are allowed to grow until they turn the scale at $3\frac{1}{2}$ lbs. when twelve or thirteen weeks old.

The pullet chickens are not likely to be all the same value as regards their laying powers. At three months old culling should begin; all those which do not attain the desired standard may be fed off for a week or ten days and killed. Culling should not be

[Photopress

JUST HATCHED

done in one operation; in fact, it is impossible to do it thoroughly with birds of this age. The unwanted birds should be picked up as soon as their defects are noticed. A supply of table poultry is, therefore, available for two or three months longer.

Boiling Fowls. The two-year old hens cease laying in the summer. Being past their prime as egg-producers, it would be folly to keep them over for a third season. A little extra feeding will bring them into the necessary fleshy condition for killing. As they do not all stop production at the same time they are available for some weeks.

Michaelmas Geese. Geese do not thrive when closely confined. If the garden be a fairly large one or if an orchard be attached a small number of month-old goslings should be bought in May or June. Some of these may be killed as "green" geese when eight to ten weeks old; the remainder can be fattened for Michaelmas and the month following.

Christmas Turkeys. Turkeys during their earlier stages, until they have "shot the red," are somewhat difficult to rear unless they be given their entire liberty. The solution of the problem in this case is to buy three-month old turkeys in August, preference being given to the smaller varieties, such as the Buff and the White, since these stand confinement better. Penned up in the middle of November well-fleshed birds will be secured for the Christmas season.

With rabbits, three does and a buck are an ideal number to keep. Table breeds such as the English, Flemish Giant and Belgian Hare produce 8 or 9 in a litter, and breeding can be carried on during the whole year. The youngsters are weaned when 6 to 7 weeks old and are ready for killing when from 13 to 15 weeks.

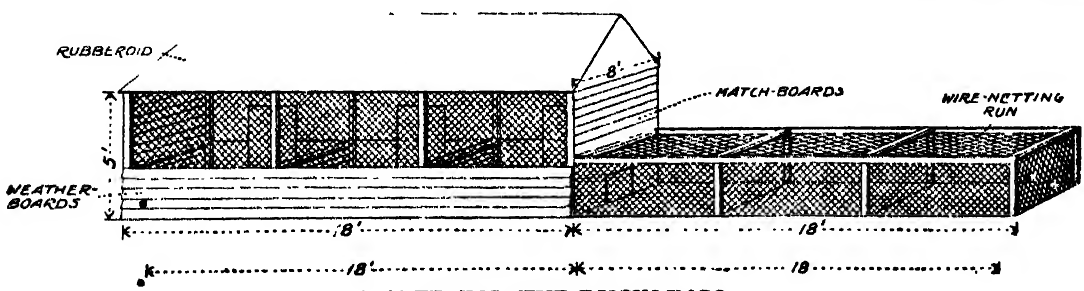
Table Rabbits. They can be housed either in stacks or outdoor hutches, but when winter breeding is practised it is preferable to erect a special shed, placing indoor hutches round two or three sides.

Dual purpose breeds are also available to-day. Breeds such as the Bevern, Chinchilla and Havana, not only make excellent, fleshy table carcasses, but their pelts are valuable for curing and making up into a variety of articles. As food production is the main consideration, however, preference should be given to those breeds which are employed exclusively for table purposes.

Squabs. Squab-raising is a fascinating garden hobby and one that does not entail much labour. The breeds used for this purpose, such as the Carneau, the White King, the Maltese and the Mondaine, are very prolific. A low estimate is 6 to 7 pairs of youngsters per annum from each mated pair of breeders. A loft containing half a dozen pairs of breeders may be confidently expected to keep the average household in a continuous supply of squabs during the greater part of the year.

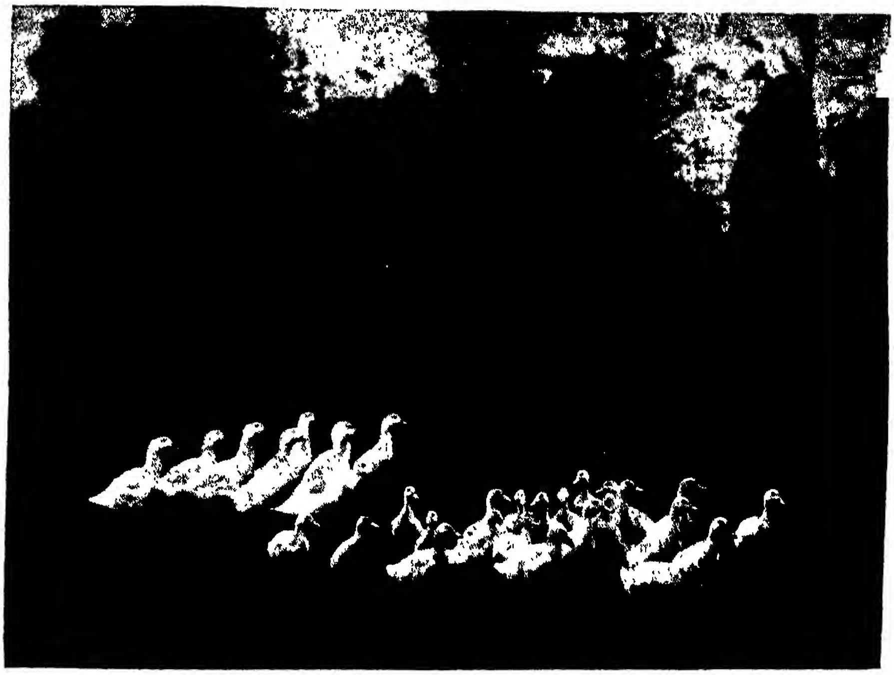
The labour entailed is insignificent. The parent birds hatch out their young and feed them until they are three and a half to four weeks old. This is the correct time for killing—just prior to the appearance of the feathers proper. Hence, the only work is in connection with feeding the breeders and looking after the cleanliness of the loft.

Mated pairs of breeders should be purchased, preferably in the early spring. These



A SHED FOR THE DUCKLINGS
A three-compartment shed for relays of young ducks—the youngest having access to the open run.

should be from one to three years old and may be retained until they are six to eight years old. Prolificacy decreases after this age is reached.



[Sport and General

AYLESBURY DUCKLINGS.

Adult and young ducks kept in the open in a small orchard.

The goat is indispensable where the garden milk supply is concerned. "The poor man's cow," as it is commonly termed, is ideal in more ways than one. A good milker will yield upwards of two quarts a day during the period of heavy flow. The milk is particularly rich in butter fat, but perhaps the greatest argument in favour of goat's milk is that it is always tubercle-free. This milk is recommended for children and invalids. It is equally beneficial for all.

The Milk Supply.

The prejudice on the part of many towards goats is uncalled for. It is not true that nannies are in any way objectionable, although a billy may be if not groomed and looked after in a proper manner. A male need not be kept; in fact, it is advisable not to invest in one. The services of a sire can generally be secured from an outside source.

The lactation period of a goat is not so long as that of a cow. To maintain a constant supply of milk it is advisable to keep three nannies, arranging kidding in such a manner that as one goes out of production another is coming into her full yield.

The quantity of milk yielded depends not only upon the quality of the animal, but upon its breed. The best breed, but the most expensive, is the Toggenburg; the second best the Anglo-Nubian—a medium priced animal; and the third best the English, which is the cheapest. The Anglo-Nubian is recommended for the beginner.

Milch goats can be kept on one of two systems. They may be housed throughout the year; on the "soiling" system, as it is called. When an acre of orchard is available a combined system of stall-feeding and pasturing is possible.

Domesticated goats will breed twice in little more than twelve months. The three nannies advised will produce five kids at the least between them in a year. Rearing the goatlings is out of the question in a garden, but goat flesh is a highly prized form of meat. The kids are ready for killing when three weeks old and the major portion of the goat's milk supply is, therefore, available for human consumption.

HOMECROFTING

By Professor J. W. SCOTT, M.A., D.Phil., Professor of Philosophy at the University of Cardiff.

HOMECROFTING originated in America; but the British movement may well be described as an attempt to break a pathway for health

principles to get through to the working classes.

The benefits of health will not come to the idle. They have to be appropriated. The two difficulties which hinder their appropriation by working people are, on the one hand, their inability to afford them; and, on the other hand, their reluctance, when they can afford them, to put them into practice.

A Homecroft is a contrivance for providing good food by means of proper housing. A Homecroft is a tiny piece of land, from two-fifths to two-thirds of an acre, with a workman's dwelling upon it. The Homecrofting art is the art of so co-ordinating the produce of the earth and the requirements of the consumer, that comparatively little of the food required by the family has to be brought into the house from outside sources. The Homecrofting ideal is the self-feeding household. Both the disabilities above mentioned are here overcome. The food eaten is always fresh, so that the eating is not a duty but a temptation. Moreover, being grown at home it is cheap.

Two objections to the system have been raised. People will remark that "it does not pay to grow one's own vegetables"—they can be bought more cheaply in the market. This, of course, is mere want of thought. It certainly will not pay a professional man earning £750 a year to grow potatoes in his summer evenings, if he begins to calculate his own time at five to ten shillings an hour, the normal rate at which he earns money. But a working man would not reckon his time in this way. Food so grown is a resource outside his wages.

From the economic point of view, emancipation of the working man from the dominion of money is the interesting point of Homecrofting. The labourer, living in a back street of some overcrowded city area, is dependent on his wages for everything. On a Homecroft he is partly relieved of that dependence. The moment wages fail, the city worker is deprived of his resources. A small business man is no better; he is dependent on uncertain markets. All who either work for wages or trade for profits are caught in the vortex of the trade cycle, with its uncontrollable fluctuations. Luxuries may be left to uncertainty, but the first necessities of life should be ensured to everybody. Where money is precarious it is necessary to invent a steady supply of food for all who are willing to work. Homecrofting is this necessary resource, The food required is on the Homecroft. If the art be thoroughly developed, the land is a perennial larder round the house, affording not only potatoes and vegetables but fruit, eggs, and even milk and meat—everything of importance, in fact, except bread and tea.

The suggestion therefore is to take advantage of the short industrial hours. Aim at two shifts a day for the man; one shift at his industrial work earning wages and another shorter shift, a home-shift, in his garden producing food. There is no need to dwell on the intense human attractiveness of this supplement to a man's ordinary means of livelihood; the difference between the two sides of his occupation; the joy and release it would be to every normally minded workman to escape after his half-day spent amid the noise and grime, to his other half-day in interesting healthy open-air work, as his own master, with his family round him.

The other objection raised against a project of this kind, is that land is too dear and building costs too high for a working man to pay for an adequate house, even with a food garden to help him.

There was a time not long ago when the answer to this objection had to be purely speculative. Nothing had been done. It is no longer so, now that the first Homecrofts are being tried in England. There are a certain number of facts which go a very long way towards demonstrating that it is possible to erect workmen's houses at an economic rent; not by keeping down the size of the houses, but by the opposite policy of giving the men an extra resource wherewith to meet the rent.

The principle is that a house which provides food as well as shelter partly pays for itself. Naturally the first experiment was

suggested in a locality where success was most probable. The view taken was that if a beginning were made on the best soil, with the best climate and the most suitable people, poorer soils and poorer human material could be gradually overtaken as methods were more perfectly mastered. The present state of the game, therefore, would only justify starting where the following conditions are fulfilled.

A HOMECROFT HOUSE AT CHELTENHAM
One of the first houses to be built on the Homecroft Settlement at Cheltenham.

Firstly, the land must be reasonably priced. It should not cost more than from £100 to £150 an acre including every thing, lawyers' fees, "searches," redemption of burdens, and all incidental expenses. This implies looking for it somewhere beyond the suburbs of the industrial town. A street of Homecrofts cannot be put inside the town itself, and of course it is not intended to be. The aim of the system is to allow the worker, like his employer, to live a little way out, if he wishes, but not too far out.

Secondly, the soil should be suitable for garden cultivation. Perhaps in the future science may devise a method of creating garden loam out of bog and clay. Electric power and a mechanical tiller plus the newer chemicals could do wonders in government hands. But for the first Homecrofts we cannot reckon to make the soil. We must find it ready-made.

Thirdly, there must be adequate sewerage; in such a community the earth-closet system might be organised to act satisfactorily.

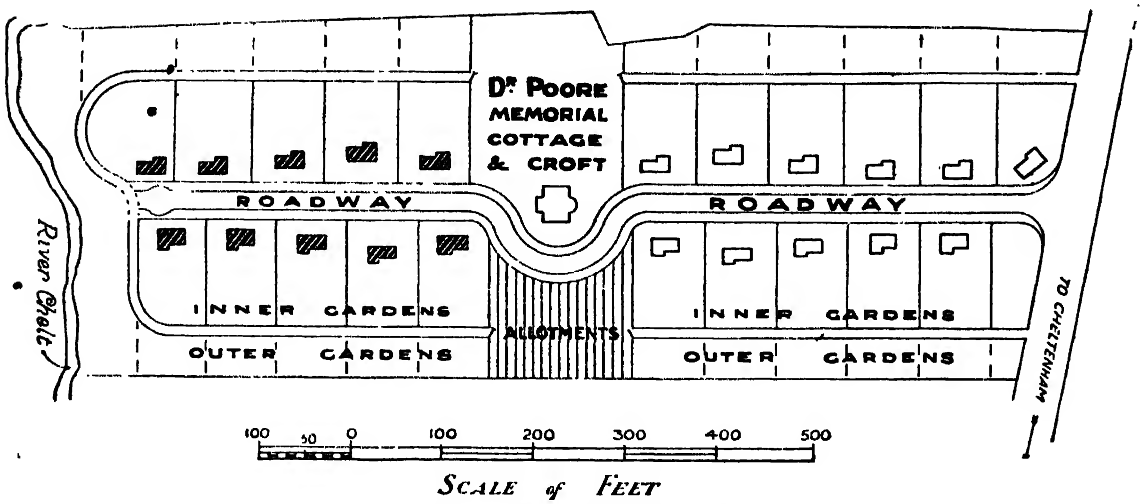
Fourthly, there must be a water supply; and there must be communications by cycle, tram, bus or train, whereby the town workers can go to and from their daily work. If Homecrofting were known, and if the simultaneous settlement of larger number of families could be counted on, water supply and communication problems would be less difficult. But even now all over the country there are towns with large stretches of good allotment land near them, to which town water can be laid on if it is not already there; and it is in such places that beginnings might be made.

If these conditions are fulfilled, experience has shown it to be possible to provide genuine working men with genuine Homecroft cottages. The following is a description of ten Homecrofts already in existence. Each stands detached in its own croft. The rental intended was 16*s.* 3*d.* per week, this sum to include a sinking-fund which purchased the Homecroft, and left the crofter freehold owner of house, outhouses, land, trees and bushes at the end of a period of twenty-five years. But it has been found better to drop the purchase plan and let at ordinary rentals.

The houses are built of concrete slabs, they are of hollow-wall construction and roofed with tiles.

A Typical Homecroft.

Downstairs they have a sitting-room 15 ft. by 10 ft., a large kitchen with cooking stove, sink (porcelain) and wash boiler, a 7 ft. by 5 ft. bathroom, a larder 4 ft. square, a covered way and porch to the external earth closet, and a coal store. A 3-ft. staircase leads to the upper floor where there are three bedrooms and a large hanging cupboard.



A CHELTENHAM HOMECROFT SETTLEMENT
Diagram showing a partly built settlement. The ten finished cottages are shown shaded, each in its own ⅜-acre croft.

This five-roomed house is set in a garden planted with fruit trees, etc.; and in every garden is erected a wooden outbuilding, an animal house, specially designed to accommodate ten hens, six pairs of rabbits, the garden tools, and a pair of stall-fed goats. For detailed suggestions as to the best layout for a Homecroft garden, see the article on "The All-Round Food Garden."

It is clear that a system like this, carried out on a large scale, promises benefits to the country even beyond securing the health of its working people. Think, for example, of defence. We are fifty million people living on an island with only food for ten millions. What makes Homecroft experimentation stand out among defence measures is that it is not destructive work, but constructive—even missionary—work.

The very process of turning out our slum populations and scattering them over the green fields to feed themselves, is missionary work. There are, of course, difficulties in making Homecrofters out of the poor material of British slum-dwellers. But there is power in the prospect of a new home, and inspiration in moving out of a slum hovel with wife and children into a house where there is half an acre in which to disport themselves. *That tide of new feeling in the breast is the real dynamo which is to create life anew.* It only needs to be handled with some psychological insight. Such healing of the spirit probably cannot be done at once; or until many actual Homecroft settlements have been organised among likely people in likely places and the croft system thoroughly mastered. But after that, all the slum-clearing should be approached in a practical missionary spirit, the whole population of the "condemned" area circularised, their hopes raised in the new life that awaits them. If in a few extra houses were placed a small band of practised allotment-holders who would like to have a bigger plot and their house on it, their presence would ensure that some in the colony would do well, and would serve as an example for the others.

This initiation can be reinforced by suitable education of the young. And here emerges another side of the subject, Homecroft education.

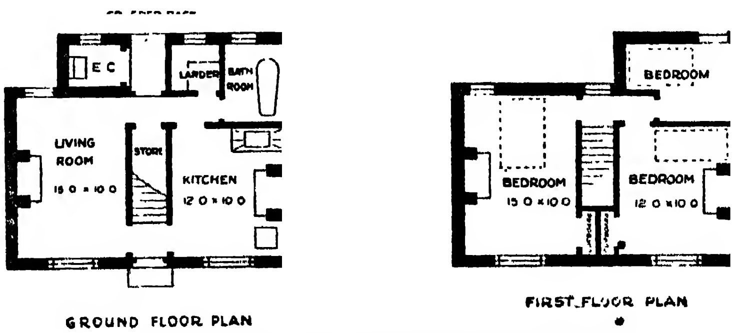
Education.

The adult population of the slums may be broken earthenware; but the children are not. They have it in them to love the earth and all that belongs to it. Ancestrally we all came from the soil, and the ancient love of the earth is still there, even in the slum-dweller. It may be deep-buried and long-forgotten in the fathers, but it can be awakened in the children. This is a question of education, and Homecrofting

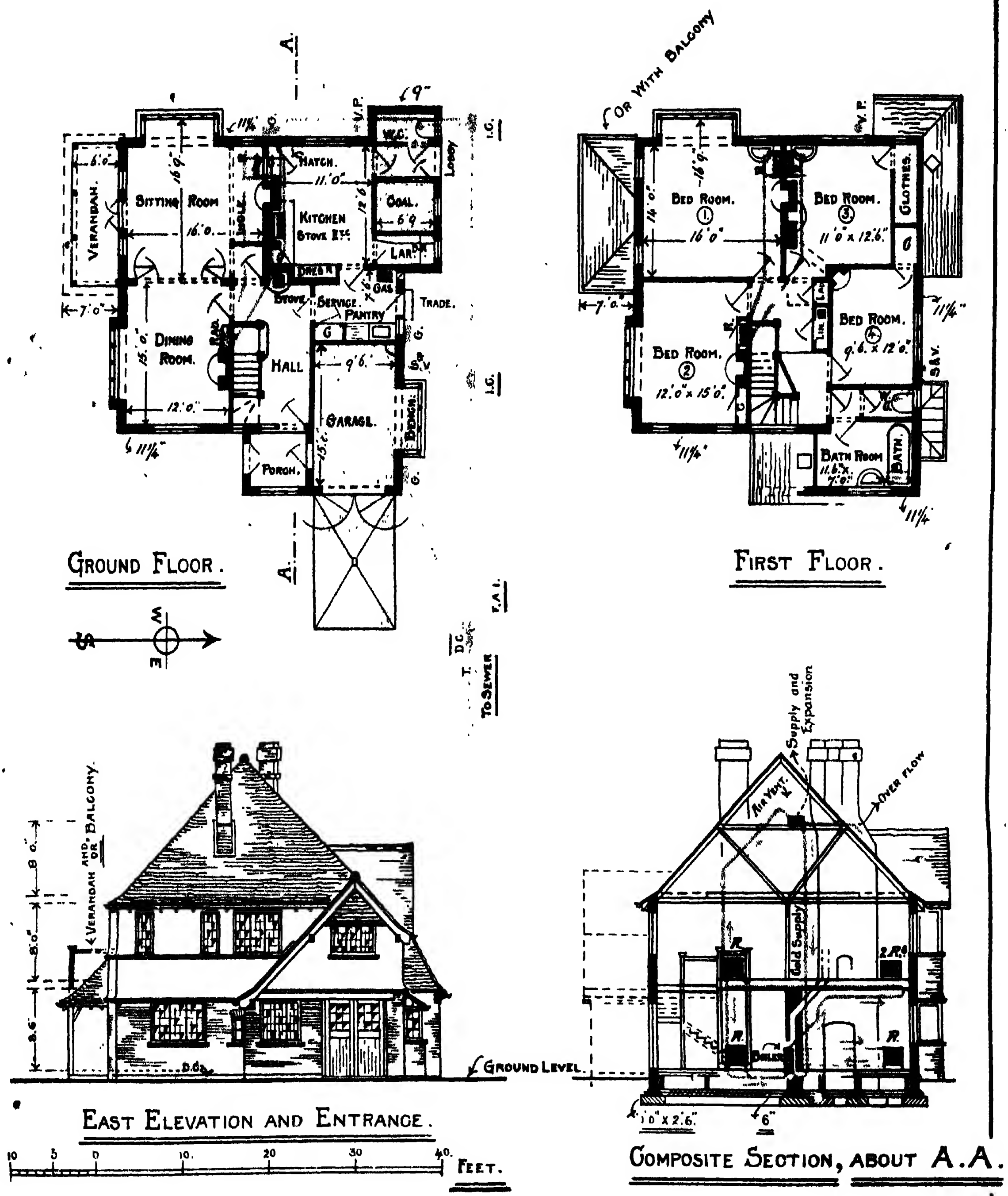
lends itself to every purpose of education. The effectiveness of Homecrofting as a focus of the work of the school is unsurpassed. Almost every school subject of importance takes on a new meaning when related to a piece of soil and man's immemorial task of living on it.

In household management, for example, the full domestic economy of the garden home—a home whose supplies come raw out of the garden—should be taught as well as health lessons on the right composition of human food. In a Homecroft the children are not only learning to know intellectually what is good food ; they are practised in producing it and are taught to know how it tastes. Going deeper, where else in the world is the delicate initiation of the minds of the young into the great natural facts of life, the facts of birth and death and generation, more perfectly accomplished than through simple silent association with all the various life of the plant and animal kingdoms with which their Homecroft is teeming ? It is almost the only environment in which the children have the chance to learn naturally the deeper facts of their kinship with Nature. Nor is Professor Dewey's workshop left out, for of course a workshop is a necessary adjunct of a Homecroft. As to the natural sciences the points where their teaching can be brought home are numerous ; the chemistry of the compost heap, the botany of the beanstalk, the zoology of the hive, the mathematics of the onion beds, the arithmetic of the all-important " Homecrofter's book-keeping." Except for a few subjects, such as history and literature, the relevance of the experience required in a food garden to what is taught in the school curriculum is almost complete. And finally it must be remembered that all these incidental opportunities and occasions for developing the *educated* mind, tend to create the *morally disciplined* mind, since they rise within a milieu where work (and co-operative work) is the dominating note ; and work perhaps more than anything else, even more perhaps than sport, truly forms and develops character. The educational side of Homecrofting has not yet been realised as such a concrete fact as the Homecroft housing. But a complete scheme for Homecroft centres in rural schools has been worked out and brought to the notice of a committee of the Welsh Board of Education.

Just as Homecrofting makes for health, physical, intellectual and moral, just as it saves the country in time of scarcity by entrenching every family beside its own food supply, just as it offers an education for the young which correlates hand and heart and brain, at the same time training them to live and not merely to climb over one another's heads in the scramble for clerkly jobs ; so, finally, it approaches the unemployment problem by offering a remedial measure—houses that provide employment. Homecrofting has no " open sesame " wherewith to deliver from the ups and downs of the trade cycle, but it enables men to live through them. This it does by the offer of a new conception of education ; and Homecrofting is perhaps most deeply a movement for educational reform. But in and through all the various things which it is, it is consistently and always a plea for attention to the welfare of the masses of our people—those who must always work with their hands. Our duty to them is to educate them so that they can at least have a happy family life. No man is hindered from rising by learning to do real work, but clearly everybody cannot be at the top. We would therefore educate



A PLAN OF THE HOMECROFT HOUSES



THE IDEAL HOUSE.

Sketch drawings for a representative small dwelling as described in the text, specially designed by A. Ford Hannaford. It is planned for economy and ease of service, with all reasonable accommodation and fittings for comfort, light and warmth. Note: A large loft or attic is over the first floor and the bathroom contains a geyser, or, preferably, a Califont System is fitted to all H. W. draw-off taps. The heating system is indicated in green.

XXIII

HYGIENE OF THE HOME

THE IDEAL HOUSE

By W. H. HORNIBROOK, F.R.C.S., L.R.C.P., D.P.H. (Irel.), Formerly Medical Officer of Health, Mackenzie County, New Zealand.

AS individual tastes, health and occupational conditions, family dimensions and financial considerations are varying factors, it is obviously impossible to design a single house deserving the description "ideal," but it is quite within our power to describe a house "ideal" which in itself embodies all the essentials of a residence affording a healthy, comfortable, easily worked, pleasing and moderately priced environment. The house designed by Mr. A. F. Hannaford and illustrated here, presents all the factors indicated, but it should be borne in mind that this is merely a type—a type to be altered and modified according to individual requirements.

Where choice of situation is possible the essentials may be summarised thus :—

1. A dry gravel soil.
2. Position admitting of maximum of sunshine.
3. A good water supply..
4. A sound drainage system.
5. A favourable aspect.
6. A pleasing prospect.
7. Electric light and gas mains available.
8. Convenience of access.
9. Protection from wind.
10. Suitable materials and design.

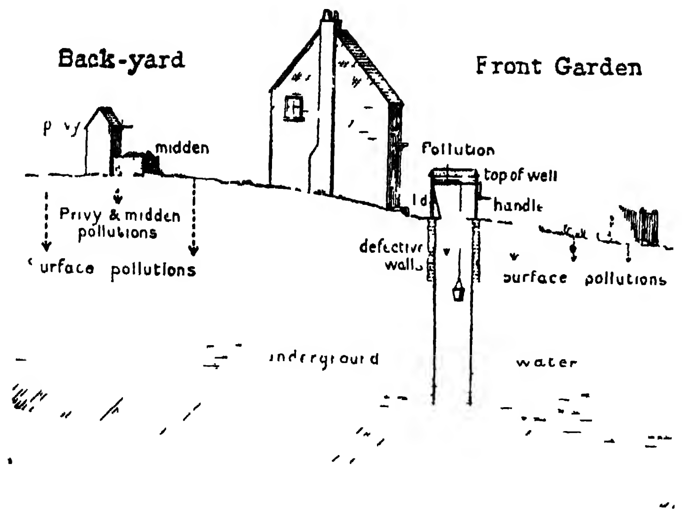
(1) A DRY GRAVEL SOIL is desirable, not only because it ensures dryness of the surroundings, but also because a house draws moisture from the ground on which it stands. It is true that houses are often built on clay lands, and that such houses, owing to circumstances apart from the nature of the soil, are both dry and warm, but this in no way affects the general statement above. A house on a clay eminence would naturally be better than one built in a moist gravel dell.

(2) A MAXIMUM AMOUNT OF SUNSHINE is of such great importance that we place it next to that of soil. Where sunshine prevails germs of disease do not. The bright rays which fade

Courtesy] [*Cadbury Bros. Ltd.*

A MODERN GARDEN CITY

The most modern type of residence for workers—individual houses attractively situated and provided with small gardens of their own.



Courtesy] ["Elements of Hygiene and Public Health," Porter (O U P)

THE DANGER OF A SHALLOW WELL

A diagram to show the various sources of contamination of drinking water in a shallow well

the carpets and tapestries bring roses to the children's faces ; the absence of them brings pallor and rickets to the young people, while the furnishings are preserved for the moth and the worm. In summertime all the world seeks the seaside, and measures the benefit received by the depth of sunburn attained ; but all the world is apt to rest content therewith until the long days come round again, forgetful that the same sun is still shining and always trying to peep into their homes Call to mind the appearance of the dwellers, the children particularly, in the slums and purlieus of cities. The greater part of their outward evidence of unhealthiness is attributable to absence of sunshine ; therefore, remember that, next to food, man's greatest want is sunshine.

(3) A GOOD WATER SUPPLY. In England good drinking water is now so general that we are apt to take it for granted, and as a rule we find our confidence justified ; but the water which is good might sometimes be better. In districts where the water supply is drawn from a chalk soil, the water, while being free from organic pollution, is frequently very hard Boiling, whereby the chalk is precipitated, renders such water much better for drinking purposes, the mawkishness being removed by pouring the water from one vessel to another a few times after it has been cooled and decanted away from the chalky deposit. Hard water has a further disadvantage, *i.e.*, for washing purposes much more soap is required, hence it is more expensive to wash in hard water than in soft. Again, a plentiful and constant supply of water facilitates housework both in the matter of washing and warming, and by its ready availability lessens labour, while upon its various sanitary applications depend many of the amenities of our civilisation.

(4) A SOUND DRAINAGE SYSTEM is as imperative as a good water supply. Sanitary engineering has rendered modern cities not only possible, but, for many, even desirable places of residence. Try to imagine the state of London if its wonderful system of sanitation were suddenly thrown out of action. Blocked sewers, choked drains, overflowing water-closets, factories flooded with their waste materials and sewage, refuse accumulating in putrid heaps, and a suffocating miasma pervading every corner of the metropolis. Disease and death would soon complete a catastrophe more appalling than an enemy's occupation. So, too, in the household, if the drainage system be faulty evil consequences overtake the residents. Public sanitary authorities generally control effectively the areas over which they exercise jurisdiction, but naturally cannot exercise a daily and minute supervision over a whole community, hence the more individual attention is directed to each particular unit the better will be the ultimate total result.

It may be well to note in passing that a cess-pit, whether of the so-called "septic tank" type or not, is an undesirable method of dealing with sewage. In very thinly populated rural districts such abominations serve, the cost of a modern drainage system being prohibitive ; but in these cases there is always present a risk, indeed almost a certainty, of contamination of the drinking

water when it is obtained from wells. Where the water supply is brought from a distance there can be no such pollution in the area of distribution. A drainage system connected with a public sewer is the ideal arrangement.

(5) A FAVOURABLE ASPECT. How often one sees houses where the question of aspect does not appear to have entered into the architect's consideration at all, or where it has been determined by the proximity of the highway, with an absolute disregard of the sun's position and the owner's comfort. The desire to turn the best side to the road frequently leads to turning the worst side to the sun, thus placing bedrooms with windows looking towards the west, or even towards the region of Arctic night, while other rooms are equally out of position. Where possible bedrooms are best with the windows to the south-east, thereby ensuring light and warmth in the rising hours.

If situated on the west side of a house the rooms in the morning are cold and dark in winter, and often uncomfortably hot at bedtime in summer.

(6) A PLEASING PROSPECT, if possible, should meet the eye, which regards the scene from a favourable aspect, but as communities grow, and buildings cover the ground, the beauty of outlook diminishes in direct proportion ; still there is usually some choice in this direction, and art may offer a substitute for the lost grace of Nature.

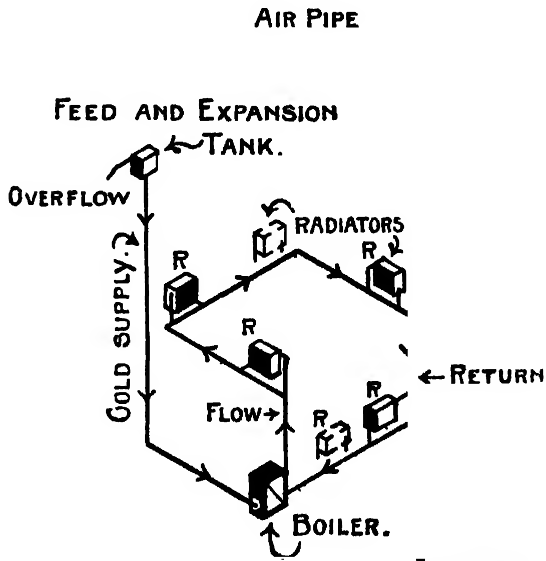
(7) ELECTRIC LIGHT AND GAS MAINS. If these are not available, the working difficulties of a household are increased considerably. The old paraffin lamp, with its dirt and smell, risk of fire, and general inconvenience, is rapidly becoming a memory of other days. Gas, too, as an illuminant, is almost a thing of the past, but still finds a sphere of usefulness in the kitchen and the bathroom as a rapid and cleanly source of heat ; therefore, it is well when possible to instal gas in every house as an accessory for such purposes.

In acetylene gas we have a very good illuminant for houses where electricity and coal gas cannot be obtained, but it has serious disadvantages. Its odour is most unpleasant, and it appears able to escape from pipes and taps in the most extraordinary manner. The generator has to be carefully looked after, and the whole plant kept in perfect order - a difficult and doubtful matter where unskilled labour only is procurable.

Petrol gas too has found a place as an illuminant. There are several installations on the market. It is superior to acetylene in the matter of ease of handling, and the quality of the light leaves little to be desired.

(8) CONVENIENCE OF ACCESS. This is purely a matter for the owner or tenant. His business or personal requirements will probably determine the locality and position.

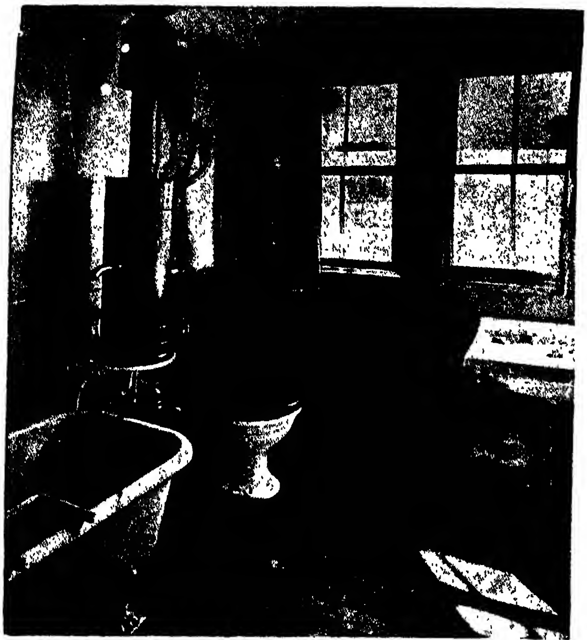
(9) PROTECTION FROM WIND. The discomfort and inconvenience arising from exposure to wind are too well known to need emphasis. Moving air is necessary for ventilation, but the rate of movement must be slow if we would live in comfort. Hence the need for care in the selection of a building site. It is generally possible to take advantage of natural physical features to some extent in this matter, and these can be supplemented by the erection of walls and planting of trees. A certain amount of breeziness is desirable,



[A F. Hannaford]

THE HEATING SYSTEM

The one-pipe ring main heating system supplying six radiators for the Ideal House described. The boiler is heated by a stove in the hall.



HOT WATER FOR THE BATHROOM
A gas geyser is a great convenience in the bathroom, to supplement the domestic hot water supply.

but the storm-swept hillside carries its own warning.

(10) SUITABLE MATERIALS. In some districts the presence of bricks, tiles, stone, slate, gravel, sand, etc., will influence the price and determine the character of the building.

THE ACTUAL HOUSE

Modern social conditions have so altered the house-keeping problem that when seeking a residence a woman's first thought is directed towards the ease, or difficulty, of working the establishment. This has led to the popularity of small houses of one or two floors. As an adult requires 3000 cubic feet of fresh air per hour we cannot go on reducing the size of the rooms to a vanishing point, for although we could by mechanical means provide enough fresh air in a small packing case the draught would render such an abode unbearable.

Fresh air constantly finds its way into a house through doorways, windows, chimneys and spaces between the floor boards. It gets heated and escapes through chimneys, windows and doors. By controlling these avenues of ingress and egress we control and ensure ventilation. The most efficient ventilator is the open fire, as it continually draws a current of air out of the room, fresh air finding its way in to take the place of that which has been exhausted up the chimney.

In heating the ideal house we depend very little on the open fire; as an accessory in the sitting-room it remains, the fireside being in a sense the shrine of home. In the sick room too it serves the double purpose of warming and ventilating, and is no small comfort to patient and nurse. An anthracite stove in the hall working a boiler which supplies hot water to a system of radiators gives all the warmth required under any climatic conditions.

In the coloured plate the composite section shows such a system, the boiler, radiators and pipes being coloured green. The arrows indicate the direction of the flow. This is also shown in detail in the diagram illustrating the heating system, on page 1491. The small expansion tank is situated in the roof space, and is also used as the filler for the system. Cold water passes down the pipe directly to the bottom of the boiler where it becomes heated, and rising, passes upwards in the pipe as indicated by the arrows, flushing each radiator and finally returning cooled to the lower part of the boiler to be again heated and so circulated continuously. As the flow to each radiator is controlled by a tap, or valve, one or all can be put out of action at will. The system dealt with here is of the simplest type. There are many others equally suitable, the selection of which will depend upon circumstances.

The modern tendency to the elimination of labour wherever possible is leading gradually to a wider application of electricity as a heat and power factor, and in the household we are seeing its employment in the former rôle more widely daily. The initial cost is perhaps somewhat high, while the daily expense compares unfavourably at present with coal and gas, but it is merely a matter of time before this ratio is altered.

Hot water for domestic use may be provided by the usual kitchener with its boiler and hot-water cistern, which supplies the various points, such as bath, lavatory basins and kitchen sink, or by some of the more modern heating appliances designed to consume cheap fuel and rubbish. Or again a Califont system, having gas as the heating agent, and which furnishes hot water on the turning on of any tap of the circuit, may be selected, while a geyser is frequently to be found in the bathroom.

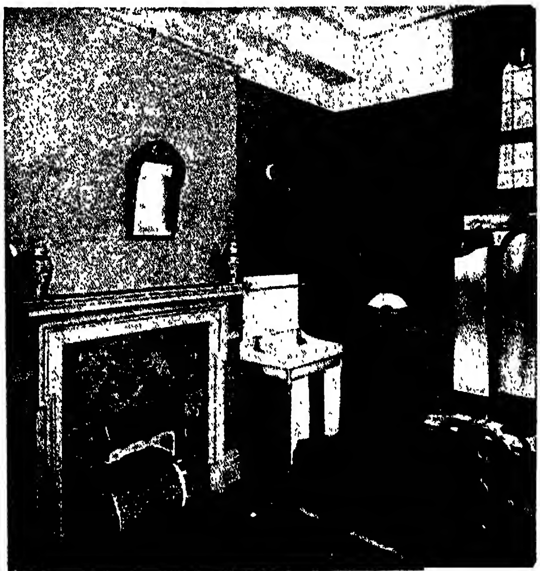
Whatever system be adopted it is always advisable to have the heating and warming circuit kept distinct from the domestic supply. In the plan it will be noticed that wash-basins are fitted in two of the bedrooms; they might with equal facility be fitted in all, and tend to eliminate work. In a nursery they are undesirable, as water has a fatal attraction for children. Cold water is obtained from a tank in the roof space provided with a ball valve which controls the flow from the service main.

In the coloured plate the drainage system is seen in red lines and blocks to the right of the ground plan. The letter "G." in each case indicates a gulley into which waste flows from a basin, or sink, through a pipe discharging into the open air above a gulley. The letters "I.C." indicate position of inspection chambers. These are provided where pipes enter the main drain, or where angles occur. "V.P." represents the vent pipe, the highest point of the system which permits of the escape of foul air from the drain, while "S. and V." indicate the soil and vent pipe on the north side of the house. At "D.C." we see the disconnecting chamber which provides facilities for clearing the drain should it become obstructed, ventilating it from its lower end and permitting the escape of its contents into the main sewer.

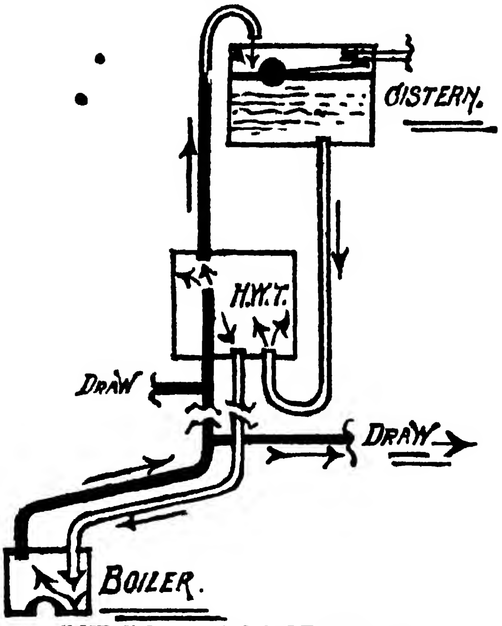
In this house it will be recognised that the position of the hall door is variable, also that some rearrangement of the rooms is possible, that the offices are capable of modification and that the sizes and heights of all the rooms could also be altered if necessary; such alterations would naturally entail the alteration of the external appearance to some extent and would have to be limited.

In the ground plan we see the well of the staircase on the left of the hall, the first step of which is represented by the curved line towards the inner end. The first floor plan shows the ample lobby at the top of the staircase, two sides of which bound a triangle whose base, completed by the lobby, forms a well which serves for ventilating and illuminating the hall. On the same lobby we notice the linen cupboard on the right separated from the ladder cupboard by the chimney shaft of the hall stove. The ladder is to provide access to the roof space when necessary. This latter is sufficiently large to be used as a large box room, or small bedroom if required. There is room enough on the lobby to carry the staircase up for the latter purpose.

It will be noted that all fireplaces are internal, that is to say there is no chimney built into an outer wall. This is economical of heat and prevents much down-draught occurring. The ample cupboards in the bedrooms are a desirable feature. The sitting-rooms are seen to be separated by a broken line. This indicates a movable partition consisting of folding doors, thus



THE BEDROOM FITTINGS
A wash basin and a gas fire, though not actual necessities, are useful and labour-saving.



THE DOMESTIC HOT WATER
Diagram of a simple hot-water supply from the kitchener with its boiler and hot-water tank to bath, wash basin, scullery, etc.

enabling both rooms to be thrown into one. The absence of a door leading directly from the kitchen into the hall has certain advantages, and is in some ways compensated for by the presence of a serving hatch to the dining-room. The presence of a gas stove in the service pantry, which might also be called a scullery, removes its unpleasantness from the kitchen. It will be noted here that provision is made for exhausting its fumes through the wall into the outer air.

The larder, being situated to the north of the house, will be cool, and is sufficiently distant from the sanitary departments to ensure safety. The entrance to the garage from the porch will be found a great convenience, and the recess in its northern wall for the bench provides a useful space without unduly extending the dimensions of the garage. It will also be seen that a washing space is provided outside with a central drain.

The position of the dining-room on the south-east corner is ideal. Bedroom No. 2 occupies a similarly favoured position. Bedroom No. 1 gets some morning, all midday and afternoon sun. Bedroom No. 3 gets the afternoon sun, while bedroom No. 4 gets a brief glimpse of the early rising sun in midsummer only. A bathroom looking east has the sun shining in it when it is most likely to be occupied, and one gets at least a semblance if not the actuality of warmth thereby.

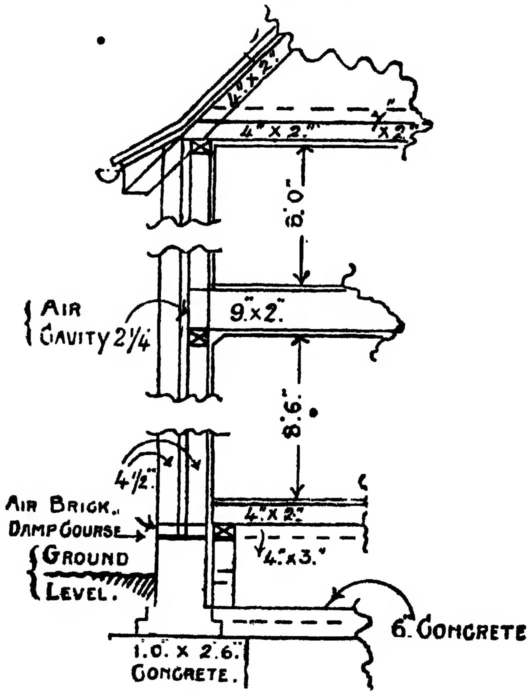
In the diagram on page 1495 we see in detail the principles of construction employed in modern houses. Below, a solid concrete base or footing, in this instance 2′ 6″ wide and 1′ thick. This is below the level of the ground surface. On the top of it rests the foundation wall, built of solid brickwork and rising to a definite height above ground. Inside it we notice a single brick wall separated by a space from the main solid wall and resting upon a 6″ layer of concrete, the latter covering the whole surface of the ground within the exterior walls of the house, and providing an impervious layer between the house and the underlying soil. On the top of the solid wall will be seen a black line marked "Damp Course." This is either a layer of bituminous material, lead, or a double layer of slates set in cement. Resting upon the top of the inner wall, likewise provided with a damp course, is seen the cut end of the wooden plate, a deal scantling 4″ × 2″ upon which rest the floor joists. This supports the flooring, which is seen lying upon the top of it. Resting on the damp course we see an air brick shown in the diagram. These air bricks occur at stated intervals and do not form a continuous course; they provide efficient ventilation to the space under the floors and at the same time keep out vermin. This ventilation is necessary to prevent dry rot occurring in the wood, and also to ensure fresh air passing into the house from under the floor boards, for air is constantly ascending from under the floors into the rooms above.

Above the damp course and between the walls we note the air space indicated by the arrow. This shows what is called hollow wall construction. The inner and outer brick skins are separated by a 2½″ space across which pass many galvanised iron tie plates. These are built in as the walls go up and serve to hold them together,

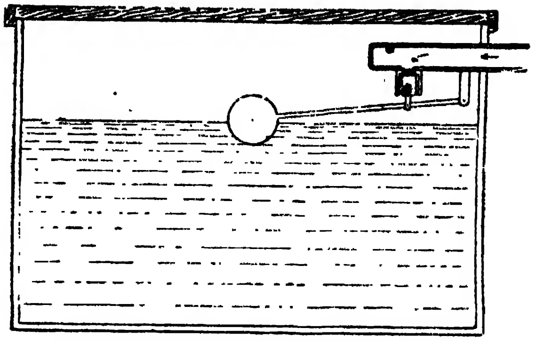
ensuring stability of the whole structure. By this system of construction rain water falling upon the outer brick wall and passing through it as it must to some extent, brick being porous, is prevented from reaching the inner skin of brick by the air space, and thus the internal wall of the house is always kept dry.

A wooden plate is usually built into the inner wall at the level of the joists for the upper floors, on which the joists rest; this is shown in the diagram, where the 9" × 2" floor joist rests upon the sawn end of the wall plate. The same is seen at the top of the picture where the 4" × 2" ceiling joist rests upon a similar plate. The thin black line under the joists and inside the vertical wall indicates the plaster with which the rooms are lined.

The surface of brickwork on the inside is left rough and unfinished to provide a key for the plaster, while a network of lathes nailed under the floor joists provides the necessary key attachment for the ceiling plaster. The days have gone when lofty



THE DETAILS OF CONSTRUCTION
Showing the concrete foundations, the damp course, air cavity, and method of fixing the floor joists, etc., in the Ideal House described.



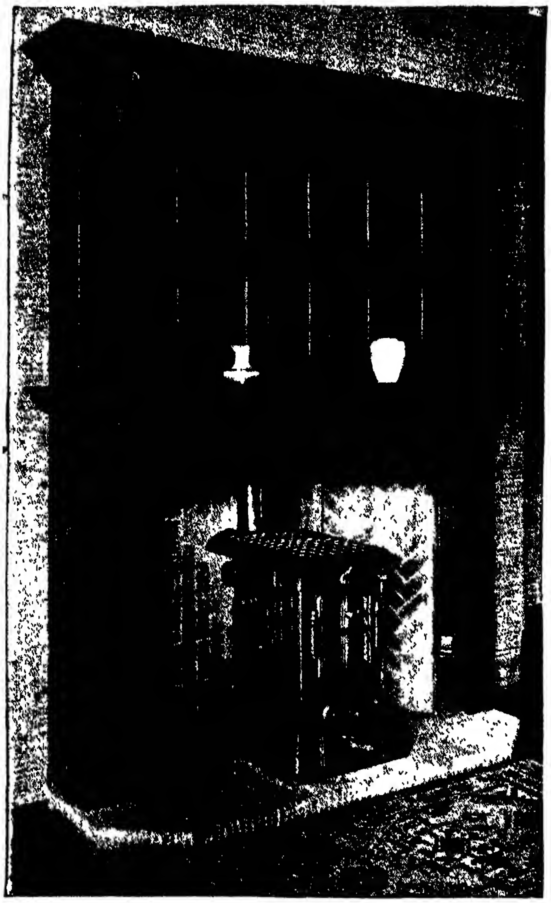
THE BALL VALVE IN THE TANK
A sectional diagram showing how the flow from the service main is cut off by means of the floating ball, when the water has reached a certain level.

rooms were supposed to provide the necessary ventilation, little or no attention being paid to open windows. In fact, closed windows were the rule at night. We now see comparatively low ceilings and better ventilation provided by windows that do open and that are opened.

The roof rafters are covered by 1" rough boards laid flat edge to edge, which in turn are covered with a felt skin (ruberoid) on the top of which parallel lines of lathes are securely nailed to provide attachment for the tiles. In some cases where economy rather than efficiency is the governing factor, ruberoid is dispensed with, feather-edged boards that lie thick edge uppermost are substituted for the flat boards, and the tiles hung on to the thick edges. Worst of all, we sometimes see tiles hung on the spaced battens. This practice should never obtain for human habitations.

The small diagram showing the water circulation is self-explanatory, bearing in mind the fact that it is purely diagrammatic, and does not in any way represent the actual plan of the heating system as installed in the house under consideration.

The cost of building necessarily varies with the market fluctuations and the wage rates prevailing at any special time. It can readily be understood that large sums of money can be expended in decorative schemes for quite small houses which do not add either to their appearance, comfort or selling value in the event of their changing hands. The panelling of rooms with oak or other hard wood has



Courtesy] [Smith & Wellstood, Ltd.

THE HALL STOVE

The radiators are heated by an anthracite boiler placed in the hall, where it helps to warm the stairway and landings also.

always appealed to a large section of the community, but the high cost of the work and the material precludes its general adoption. Still, excellent panelled effects can be obtained by the use of hard wood plywoods, easily and rapidly fixed, thus keeping the cost low. Where inner walls are treated in this fashion there will naturally be no renewals such as inevitably occur when wall-papers, distemper, etc., are used.

A BRIEF SPECIFICATION

Foundations and area covering house and garage space to be as the local authorities demand, but generally as follows :

Materials.

FOOTINGS.—To be of grizzles or other hard brick, and according to thickness of walls—set in cement.

MORTAR.—The same for honey-comb sleeper walls set not more than 5 feet apart.

DAMP COURSES.—To be Callender's bitumenous, or 2 courses of slate in cement to requisite height above ground level to all walls. Above this, the exterior walls, generally, are to be $11\frac{1}{4}''$ hollow walls (some office walls, etc., and piers may be solid), preferably built in cement mortar, with galvanised iron ties. Keyed Fletton bricks may be used for economy for all walls, but *only* above a damp course, and then the exterior surfaces must be "rough cast ;" otherwise a good hard facing brick should be used.

Ground floors are to be hollow, as later described, except where there are solid floors in tile or cement, for such provide suitable damp courses, vertical where necessary. Provide all air bricks, and leave no un-ventilated spaces or pockets under floors.

For hollow floors there should be $3'' \times 4''$ sleeper plates and $2'' \times 4''$ joists on which fix $1\frac{1}{4}''$ grooved and tongued selected deal in narrow widths. The first floor is to be covered similarly on $9'' \times 2''$ or $7'' \times 2\frac{1}{2}''$ joists resting on $3'' \times 4''$ plates, or on a level cement ($\frac{1}{2}''$) fillet, which is equally good and less costly. First floor ceiling joists should be $1\frac{1}{2}'' \times 5''$ generally, except about cisterns and boxes where they are to be $2'' \times 7''$. Cover this area with rough $1''$ boarding. All floors to have proper bearers, trimmers, etc. Roof rafters $2'' \times 4''$, hips $2'' \times 7''$, valleys $2'' \times 9''$.

Purlins about $3'' \times 5''$, or approximate, as necessary. Cover roofs with F.E. boarding to suit lap of tiles. Nail every fourth course of tiles with galvanised iron nails. (Any tile hanging to be nailed every course on properly fixed battens). All tiles, with proper hips and valleys and ridges (later set in cement) to approval.

Plasterer.

Plaster float and set or lath plaster float and set as may be required, to walls, ceilings, soffits, studding partitions, etc. In some parts it would be less costly to cover studding, soffits and ceilings with asbestos or other of the many fibrous cement boardings. (Garage, coal shed and exterior W.C. lime whited only.)

Apart from rain water, drainage to be carried out as and where required, according to local authorities' demands.

Drainage. Provide all work and material, sanitary fittings, lavatory basins, closets, flushing tanks, sinks, syphons, discharges, overflows, gulleys, best stoneware socketed pipes, cement-jointed properly set and flaunched on concrete. Air inlets, vents and manholes ; inspection and/or disconnecting chambers, traps, etc., to either sewer, cesspit, or septic tanks.

Rain water in some localities may not be discharged into main drainage. But generally it is advisable to conserve some in tanks either above or below ground ; if necessary, the rest may run to soak pits or drains, if allowed. It is supposed that, in general, a water company's service is available—which should be laid through to meet requirements.

Provide a large cold water cistern, with overflow and ball cock. Hot water for scullery, bath, lavatory basins, etc., should be supplied from kitchen range boiler, or otherwise, and should be *apart from the radiator heating system.* Connect above boiler to circulating tank, thence to the various points necessary with $1\frac{1}{4}''$ (or as may be required) galvanised steam pipes, all to proper flow. Supply and fit all requisite stop and draw off cocks, safety valve, expansion pipe—all with easy bends—no elbows.

There should be an anthracite stove with boiler in hall. (This saves one radiator.)

Radiators. Connect to all radiators, etc. Provide and fix one radiator in each of the two sitting or dining-rooms—and perhaps the pipes may be brought under hall to garage to another radiator. Provide and fix one radiator in each of two or three bedrooms. The one or two others should be kept fairly warm by the heat below or adjacent hot-water pipes.

Supply and fix, with all labour and material, galvanised steam barrel pipes with easy bends (no elbows) laid to proper flow and return. Expansion tank with ball cock and service, and overflow in loft, safety valve, etc., as may be requisite. Most of the fireplaces should be wholly or partially internal. (This is indicated in sketch.) The offices and side entrances should be under cover. The kitchen should be separated from main hall ; and meal service should be through a service pantry or (occasionally) through a double door serving hatch.

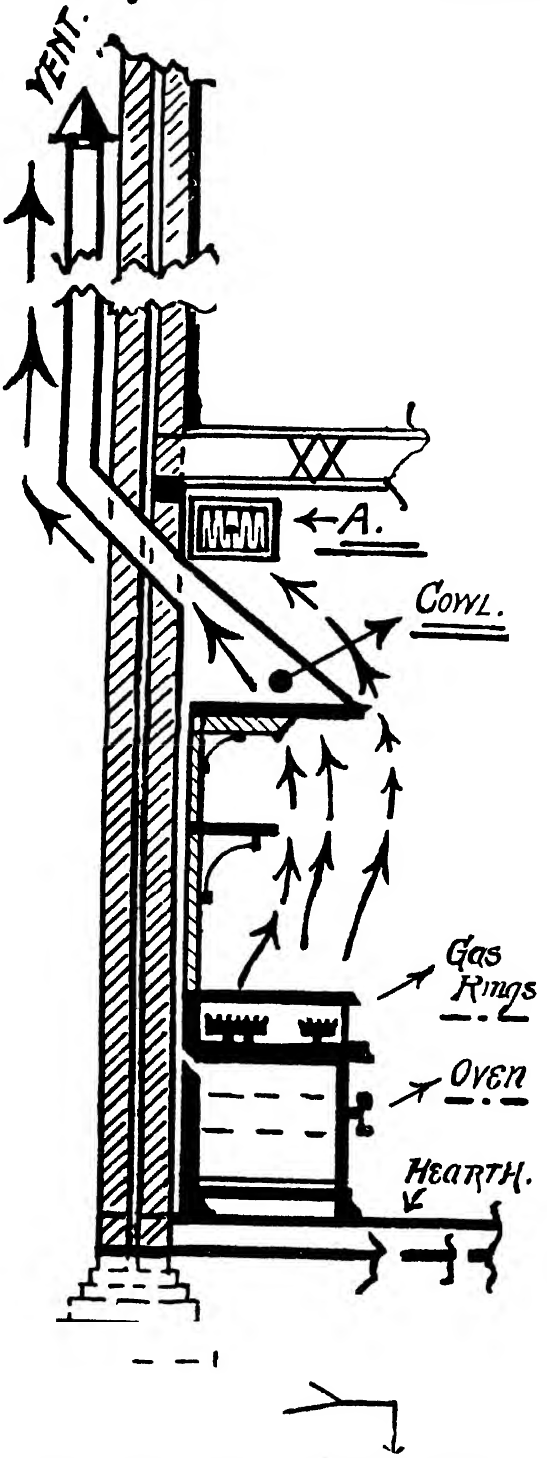
The gas cooker may be in kitchen or scullery, according to plan, and/or requirements. Note than an efficient cowl ventilator

Courtesy] ["Good Housekeeping"

A HANDY LINEN CUPBOARD

The shelves can easily be fitted with special curtains to protect the linen from becoming soiled at the edges.

and flue should be arranged above. It is desirable that gas points be laid to some fire-



VENTILATION FOR THE GAS COOKER
The cowl and its own vent, and the mica outlet vent "A" may both be used, though one alone is generally quite safe.

places. A geyser should be installed in bathroom—with proper ventilation. A luxury would be a gas-heated Ewart's "Califont" (*i.e.*, extra hot water service to hand-basins and elsewhere). Hot water is always instantly available simply by the turning on of any tap on the system, for use in summer or when fires are not lit. But perhaps the additional cost for this and its fitting and plumbing, in some cases, would be prohibitive, although it should be noted that the cost and fitting of the geyser would be saved.

Windows should be, for such a house as this, generally of a standard metal type such as Crittalls. Such are well designed for maximum light and for freely adjusted ventilation. Their maintenance is less than those of a joinery kind. Where casements do not open, top hung ventilators should be provided (or as may be needed). These single or composite lights look better if set in rectangular wood frames, with properly weathered oak sills; below, there should be two courses of roofing tile set sloping in cement, projecting beyond the face of the wall to form a drip. A similar double course of tiles should be set close above window heads to form weather hood the reason is clear- other kinds of impervious material may be used for these needs. The porch should have a large window and double glazed doors if very exposed, and the position of door and window should be according to the position of the road, aspect and prospect.

Windows.

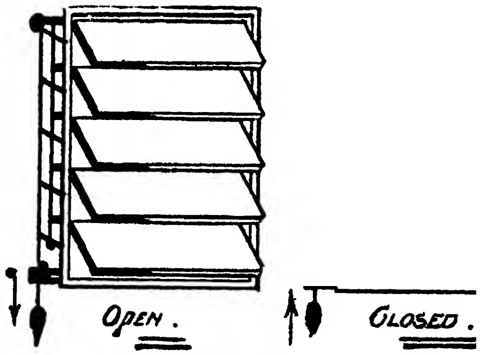
There is a roomy and shady verandah to the south, reached by folding garden doors from the sitting-room. A balcony over (with sun blinds) might be desirable, if not too overlooked. There is an entrance to the garage, *under cover*, from the house through the porch. There are roomy cupboards, combined with dresser in kitchen—also in pantry and hall.

The linen cupboard is on first landing (not in bathroom) as is also a ladder enclosed in cupboard and a *glazed trap-door* to reach a spacious box and cistern room in roof; this is well lit and a part could well be converted into an extra bedroom or studio with a top north light.

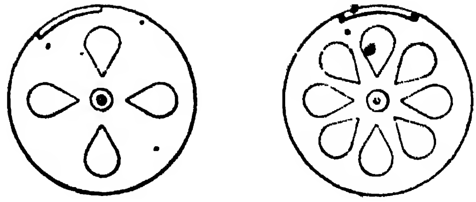
There is ample space for fixed cupboards in all bedrooms and bathroom, kitchen, pantry and elsewhere—without inconvenience. All parts of the house are generously lit, heated and ventilated. There are *no* dark corners. The triangular well of the staircase lights the hall thoroughly from the large east window on the first landing.

The plan is economical and has been designed with a view to the easiest service possible. The roof plan is simple, and lends itself to picturesque elevations. The projecting bench space in the garage allows this to be smaller in floor area, and less in cube than is usual, though the convenience and working light are greater. The dining and sitting-rooms can be thrown into one by shutting back the double folding doors separating them, thus forming a large entertainment room and ensuring thorough ventilation and light, and diffused warmth from either end when desired.

Most of the rooms receive the maximum amount of sunshine according to aspect, owing to the placing of the windows. The rooms to the south receive the summer sun from N.E. to S.W. or S.E. to N.W. respectively. The kitchen and room over from S. to N.W. On a level site, such a house, as described and roughly specified above, built according to the sketch drawings herewith, should not cost more than £1,900, with everything of the best, according to the various needs.



LOUVRED PANES
A small ventilating device to open on pivots, regulated by hand.



A GLASS VENTILATOR
A pane of glass perforated and fitted with a revolving disc : open (*left*) and closed.

VENTILATION

When an animal inspires it draws air into its lungs. From this air the blood cells abstract oxygen, which is required for the tissues. At the same time the blood discs give up carbon dioxide gas to the inspired air. This carbon dioxide is the last phase of the materials used in the body for its life processes. When the act of expiration occurs, this air, which is now impoverished of its oxygen and enriched by the addition of carbon dioxide, is returned to the atmosphere. An adult during each inspiration takes in about 500 c.c., nearly a pint, of air.

It also becomes heated, hence it is evident that the breathing of cold air demands more fuel from the body to warm it than would warm air. Also, no matter how dry the air we breathe we always send it back thoroughly soaked with water, saturated with water vapour, and at the same time we add any disease germs which may be caught in the outflowing draught. Thus it will be seen that air which has been breathed is not a pleasant or useful thing to take into our bodies. A further source of pollution is the sweat, an average quantity of a pint and three-quarters being contributed by each individual in the community per twenty-four hours.

It has been estimated than an adult requires 3000 cubic feet of fresh air per hour. This can be obtained by changing the air several times per hour if the room be small. Thus, a room 10 feet square and 10 feet high would contain 1000 cubic feet, and if the air were changed thrice during the hour the necessary standard of purity would be maintained. If a room large enough to supply the

requisite quantity of air for a given period were hermetically closed on its occupant he would feel very uncomfortable before the time-limit had expired. Headache and drowsiness, with restlessness and general discomfort, would develop. If, on the other hand, he were confined in a small cell provided with ample ventilation he would experience no inconvenience from want of air.

This serves to illustrate the fact that it is not the size of our rooms but the ventilation of them which matters. But if the rooms be too small a sufficient supply of the outer air at the low temperature of winter cannot be admitted without rendering the room chilly, hence we may err in that direction if the present tendency to the building of miniature houses be not restrained.

Effects of Impure Air.

By impure air we generally understand air which contains an excess of carbon dioxide, the gas given off from the lungs of animals, and from the combustion of coal or other carbon-containing substance. There are also added to the expired air certain organic emanations. We note their presence in the air of crowded rooms by the stuffy smell. The continued breathing of such a vitiated atmosphere leads to pallor, headache, lassitude, and drowsiness, while if the practice becomes habitual positive ill-health will follow.

Fresh air is a mixture of the gases nitrogen and oxygen in the proportion by volume of 79 parts of nitrogen and 21 parts of oxygen in every hundred volumes, with minute traces of carbon dioxide, ozone (a form of oxygen) and argon in addition.

On the presence of oxygen depends the possibility of life in the animal and vegetable kingdoms. Ordinary combustion, too, is carried on only when oxygen is present. The vital phenomena occurring in respiration are a slow form of combustion. If the supply of oxygen be diminished the animal becomes starved of its most vital necessity, and suffers in varying degree; and if the amount be reduced below a certain limit the animal dies—the fire goes out. Again, if poisonous gas be added to the air or oxygen which the animal is breathing the same results supervene.

If, instead of diminishing the oxygen, we increase the supply, we note its effect in the more fiercely burning fire or light, such as the oxy-acetylene light. So in cases of illness where the breathing is interfered with, as in pneumonia, we administer pure oxygen to try to cause the human furnace to burn more vigorously until the critical period is passed. The animal kingdom by adaptation has tuned its respiratory apparatus to work most efficiently in the air mixture of oxygen and nitrogen as we find it in Nature. If we alter the ratio or constituents of the mixture, we are upset in direct proportion to the amount of change we effect in our atmosphere, hence this need for preserving its purity is ever with us, and will not tolerate much interference.

The fresh air enthusiast is frequently looked upon as a nuisance and a crank; he often is both, but his offending is less than the stuffy fussiness of the person who feels a draught in every telephone box, and scents a cold in every change of wind.

For those who desire it the actual percentage composition of air is given in the subjoined table:—

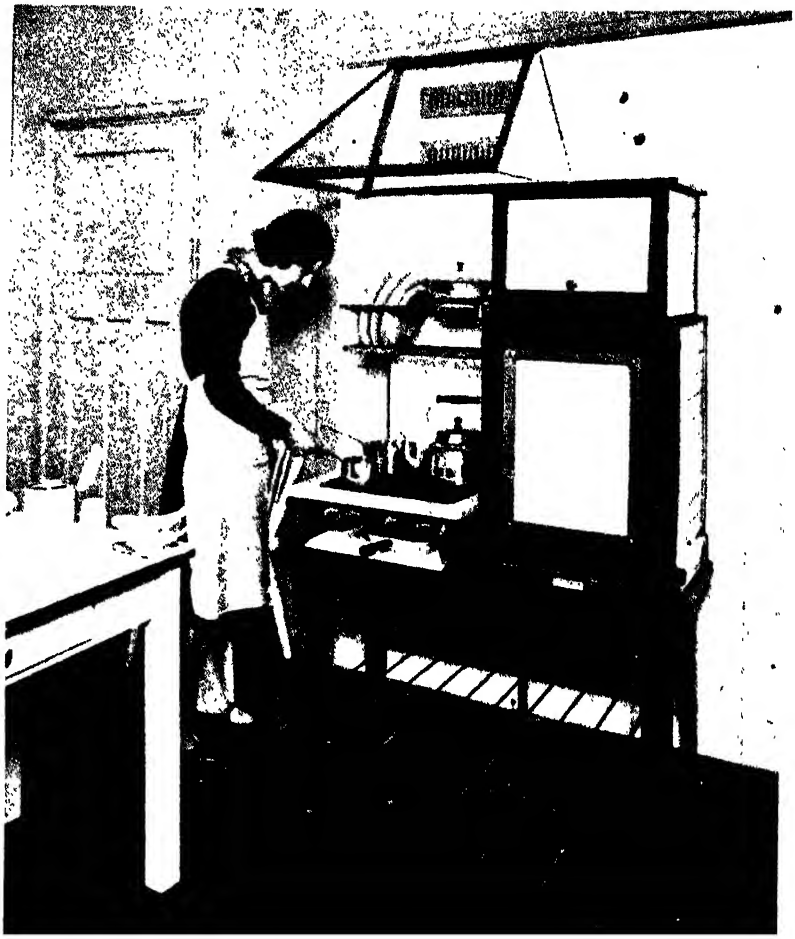
	Per cent.
Nitrogen	78.07
Oxygen	20.95
Carbon Dioxide	0.03-0.04
Argon	1.00
Hydrogen, Ammonia, Neon, Krypton	Traces.

Ventilation, or the displacement of vitiated air by pure air, depends upon the physical properties of air; and by controlling these we can modify the phenomena to suit our own purposes. When air is warm it expands and weighs less than when cold, the warm air consequently rises, while its place is taken by the heavier cold air. In the same way a balloon filled with hydrogen gas rises in the air, because the gas is lighter than the atmosphere.

Now, as the air inside a house becomes warmer than the outer air because of the presence of fires and lamps, it expands and escapes through any apertures, such as doors,

windows, chimneys, and also through every tiny crack and cranny in the building. It even passes through the walls themselves in small degree. As it passes outwards, selecting the higher avenues of escape, owing to its lightness, the heavier cold air comes into the building to take its place, and thus a constant interchange is established.

It will at once be evident that unless this were effected in a gradual manner the temperature of the rooms in cold weather would be continually altering owing to the presence of draughts.



A NEW VENTILATING DEVICE

The glass hood above the gas stove collects the steam and gas from the cooking food and from the oven outlet and allows it to escape through the special flue in the wall.

Artificial Ventilation.

In large buildings, such as theatres, etc., ventilation is assisted by various mechanical devices, such as electric fans, which either exhaust the impure air from the interior while fresh air is admitted through special inlets, or which force fresh and generally warmed air into the building; or a combination of both methods may be applied. Heat also is employed for removing foul air, as can be seen in the special gas burners fixed in roofs. Steam extraction provides another means of artificial ventilation, while specially designed grates, which act in the double capacity of warming and ventilating, are also employed.

The dwelling house, however, has generally to rely upon simple natural ventilation, the fire being the only auxiliary. As explained above, the effect of fires in ventilating houses is very definite and considerable. The current of hot air mixed with the products of combustion which streams up the chimney at the rate of three to six cubic feet per second rapidly empties a room of its air, or rather draws a constant draught from it, which is replaced by outer air pouring into the room through any openings it can find, such as the doors and windows, or the chinks around them; through the joints of the floors, and even through the walls, as explained before.

Natural, as distinct from artificial, ventilation is dependent upon the inherent properties of matter. If gases be brought together in a container they mix with each other (when they do not chemically interact), or diffuse, and the rate of diffusion depends upon their relative densities.

The effects of varying pressures are seen in the action of winds. When the wind meets with an obstruction, as, for instance, the walls

of a house, it presses against them in the same manner as flowing water presses and piles up against an obstruction in its course. The result is that some of the massed-up wind finds its way in through any openings presented. Again, when wind passes over a chimney it exerts a suction action, and this causes air to ascend in the chimney. Here we see two effects of wind; the one positive, the other negative; but as winds are variable their effect is inconstant, and cannot be relied upon.

The effects of heat on air have already been noted, and require little further explanation. It should, however, be remembered that when the rate of inflow of external air exceeds three cubic feet per second the setting up of draught is inevitable. This is a practical argument against the small and often wrongly labelled "cosy little" room. There are various devices for aiding natural ventilation, such as boring a series of holes in the lower part of the upper window sash, or fitting a narrow board under the lower sash, which, being thus pushed upwards, leaves a space between its upper end and the lower end of the upper sash. Sometimes a pane of glass is perforated and fitted with a revolving disc, or louvred or hinged panes may be fixed. In modern houses iron casements are commonly in use, and these, being hinged, allow much latitude in the matter of opening. In connection with these hinged casements it may be well to point to the necessity of having all those beyond reach from outside hung with hinges which allow of the cleaning of the windows from inside.

If on entering a room a feeling of stuffiness be experienced it is certain that the ventilation is inadequate, and as this first sensation is rapidly lost its warning should be acted upon instantly. We see this whenever we enter a relatively crowded railway carriage. The first breath often makes us gasp, yet in a few minutes we have forgotten the humanity of the compartment in our absorption of the daily news. Our sense of relief on leaving the train is the measure of our discomfort while in it.

WATER SUPPLY

As water is essential to life, and as on a plentiful supply of it depends the well-being of a community, the matter is rarely left to individual initiative. Among European peoples the Romans long ago learned all there was to know about the personal use of water, and have left us architectural and clinical records to which we can add but little. For a long interval of time after the fall of Roman authority, the uses of water in Europe were almost entirely restricted to the animal call of thirst, and the occasional employment of it in ceremonial and incantation.

Scientific advancement, with dissemination of the knowledge of sanitary principles, has led to a daily increasing use of water both for personal and public requirements. It is not yet ancient history that houses were almost wholly unprovided with bathing facilities. The man who had spent years in the East, and who had acquired the habit of a daily bath was looked upon as a little mad, and could only indulge his mania within the restrictions of a wash-basin or bucket standing on a mat in his bedroom. In fact, we still find a lamentable survival of this "hydrophobia" in families where a Saturday night bath is surrounded by all the difficulty and mystery of a sacrifice.

Sources.

Every schoolboy knows that the rain in which the lowering cloud descends is the water stolen from the ocean's breast by the smiling sun. He also knows that when the raindrops have sunk into the earth they restlessly seek each other, and never tarry in their hurry back to the great mother from whom they were cajoled; and so they go on through time pursuing their endless round. The earth's surface is like a pie-crust composed of many layers pressed close together, heaved up in little mounds in places, dipping down in little hollows in others; and where the air bubbles have risen between some of the layers they are broken or bent and cracked. In the places where the hollows occur, as in the valleys between hills, we get the layers stretching from the mountain-tops on one

side to the mountain-tops on the other; and it can be seen how water running down from the higher parts will accumulate in the lower if it cannot get away.

Now, as water always seeks its own level it will escape through any hole or crack below the level of the highest point where it may be trapped; thus we get springs and wells. But as the earth's crust consists of many layers, some porous to water and some quite impervious, it will be evident that, owing to faults and cracks, water will get between the layers as long as it can find a way downwards, until it is held in basin-like folds or strata which neither leak nor absorb it. If a hole be sunk down to the level of the water in one of these reservoirs the water can be drawn or pumped up. If a hole be bored or a crack exists at a lower level than that of the contained water it will escape, either as an "artesian well" or as a spring if the point of exit be below the water level.

The water accumulating in the upper stratum of the earth's surface is spoken of as "surface water." It generally rests upon a water-tight layer of clay. It is uncertain in volume and very impure, as it contains all sorts of animal and vegetable matter in solution and suspension. Water obtained from deeper layers, which has probably filtered through gravel and chalk beds, is generally pure except for the dissolved chalk which makes it very hard. Such water frequently has a large quantity of carbon dioxide gas dissolved in it, which increases its palatability.

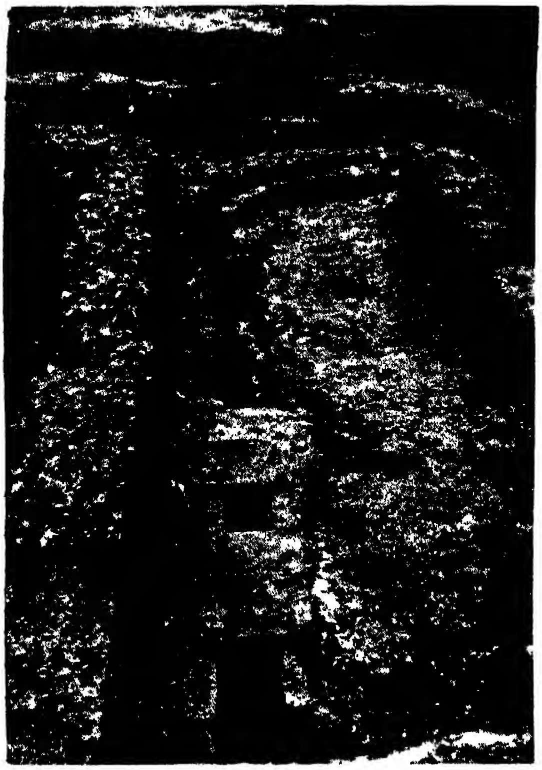
All the water of the world may be described as rain water. Whether we look at the tiny runnels by the roadside on a wet day, or think of mighty rivers like the Ganges or the Amazon, or sail over again in memory the measureless expanse of ocean, we are considering rain water all the time, but, as we find it in rivers and lakes as well as buried out of sight in the earth, we describe the water found in any of these situations by the name of its temporary residence. Thus we speak of rain water and river water; surface and deep well water.

THE RESULT OF HARD WATER
A kettle "furred" with lime boiled out of water from chalky soil.

Rain water when first formed is perfectly pure, but as it falls through the air it absorbs gases, and collects particles of dust, soot, vegetable spores, pollen, etc. It will thus be seen that rain water is much purer in the country than in towns. Where no regular water supply exists people depend upon this. The roofs of houses and other buildings are employed as the catchment area from which the water is conducted through pipes to underground storage tanks. It is almost needless to point out that under the best conditions this water is subject to much pollution. The excrement of birds, and dust, both organic and inorganic, vegetable growths which give the "weathered" appearance to tiles, and any accidental air-borne foreign matter all collect on roofs, and are washed into the cisterns during rainfall. We note the presence of this type of impurity when rain water is heated by the ammoniacal odour developed.

Rain Water.

Rain water being free from mineral salts is very soft; that is to say, that soap lathers freely in it, and that it has good cleansing or solvent properties; hence it is economical for washing purposes but it has a mawkish taste, and may be unpleasant and unsuitable for internal consumption owing to the presence of the impurities noted above, or to others taken up from the tanks in which it is stored. Some of these disadvantages can be obviated by boiling, but drinking water



[E. C. Youens, Dartford

A ROMAN DOMESTIC WATER SYSTEM

A water conduit excavated in a Roman villa at Darenth, Kent, which contained baths and arrangements for an adequate water supply.

stored in cisterns is liable to contamination at any time; and, if the reservoirs are built of concrete, and placed below the ground level, the risk of pollution by sewage, etc., is much greater, as concrete walls often develop faults. We frequently find that the well water at seaside places is brackish owing to salt water finding its way into the subsoil, and when sewage contamination occurs the risk of typhoid infection is always present.

In former times water was frequently stored in leaden tanks which caused lead poisoning amongst those who drank it. Nowadays lead is not used for such purposes, but soft water led to the tap in lead pipes may cause poisoning, especially if it has been in the pipe for any length of time before being drawn off. It is to be noted that it is the constant use of such water which causes lead poisoning, the process being an extremely slow and insidious one.

Rain water, water from peat lands and many river waters are soft. On the other hand, water coming from chalk strata, that is to say, from many deep wells, and certain river waters in limestone districts are hard, owing to the chalk or lime which is dissolved in them. These waters are generally palatable, but are bad for washing purposes as they require relatively large quantities of soap to produce a lather.

Hard and Soft Water.

By hardness in water we understand two separate conditions, viz.: (1) permanent and (2) temporary hardness. Speaking generally, it may be stated that the former is due to the presence of sulphates, the latter to carbonates of lime and magnesium.

Temporary hardness may be removed by boiling; the deposit which furs the kettle and blocks the hot-water pipes of the kitchen boiler being the chalk boiled out of the water. In large quantities such hard water may be softened by the addition of quicklime, and either filtering out the deposit, or allowing it to settle to the bottom of the tanks.

Permanent hardness is overcome by adding soda. There are several special processes in general use for the treatment of hardness which appear to give very good results.

The deposit of chalk in boilers sometimes gives rise to explosions. The chalky lining cracks, the water then comes in contact with the hot metal, which causes a sudden production of steam and increase of pressure resulting in an explosion. When water is polluted by organic material it has to be treated in various ways before it is fit for use. Thus, briefly, it is stored in special tanks for definite periods, it is subjected to filtration and aeration, and at times it is exposed to electric processes.

The subject of hardness is the greatest domestic economic factor in connection with water. If it were possible to run two identical households in exactly the same way, one using soft water and the other hard, the difference in outlay in soap alone during a given period would be very considerable.

The highest possible standard of purity in every way is, of course, the ideal for which to

strive, and it may be said that in England at all events this standard is fairly well maintained where urban authorities and water companies are influenced by public opinion or controlled by legislation. In some rural districts there is still much room for improvement, but the question of cost will be the final argument in these cases.

The quantity of water required per head per day is estimated at thirty gallons. The subjoined table shows this in detail :—

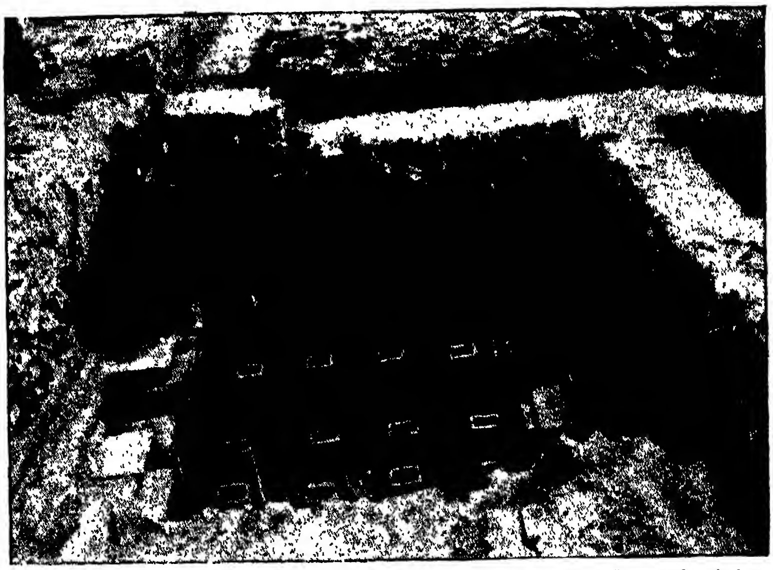
		Gallons.
Household	Drinking	0.33
	Cooking	0.75
	Personal Washing	5.00
	Dish and House washing	3.00
	Laundry	3.00
	W.C.	5.00
Trade Purposes		5.00
Municipal	Street Cleaning, Public Baths, etc., Flushing Sewers, Fire Extinguishing	5.00
Unavoidable Waste		3.00
		30.08

This, it must be remembered, is the average figure for a community. If all had baths the total amount would have to be doubled at least. Water "laid on" to a house is generally conveyed from the nearest main by a half-inch lead pipe. This is taken to the cistern in the roof-space, where its output is controlled by a ball-valve. The tank in the roof-space supplies water to the kitchen boiler, the scullery, the bathroom, lavatories and W.C.'s. Of the two cold taps in the scullery sink, one delivers fresh water from the main—the high-pressure service ; the other from the cold water cistern, the hot water service being dependent upon the same source. It will be evident that for drinking purposes the high-pressure tap should alone be used, and it is a wise precaution to run off some water before filling the vessel. This is specially necessary in the morning as the water may have been standing all night in the leaden pipe, and if the water is soft some lead may have become dissolved in it.

SEWAGE

Where efficient sewage systems exist they rarely give evidence of their presence, but the most perfect system conceived cannot eliminate the effects of misuse or stupidity on the part of the constituent units, hence it is necessary to study drainage as distinct from sewage, since it is customary to speak of "house drains" and "public sewers."

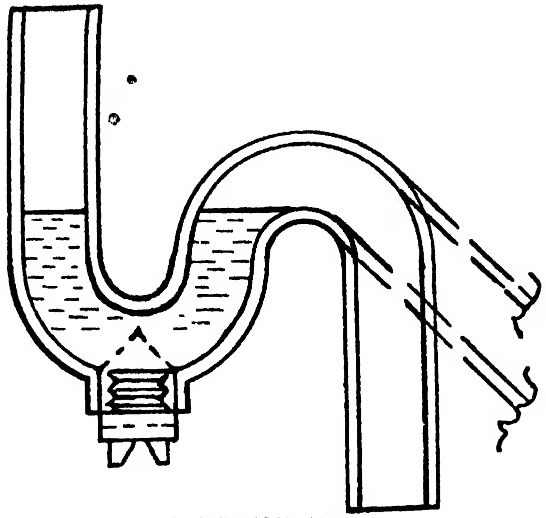
The drain is part of the establishment, and upon the owner devolves the duty of keeping it in good order ; the municipality takes over the responsibility where the drain ends. House drains are generally constructed of glazed earthenware pipes of about six inches internal diameter, jointed with cement, and laid with a fall of one in sixty. Smaller pipes require more, larger ones less fall, to provide a flow rate of three feet per second. If the rate of flow be less than this stagnation occurs ; if the rate is too rapid the liquid



[*E. C. Youens, Dartford*

HOW THE ROMANS WARMED THEIR HOUSES

The "hypocaust" at Darenth—pipes to convey hot air upwards into the living rooms from a furnace underneath.

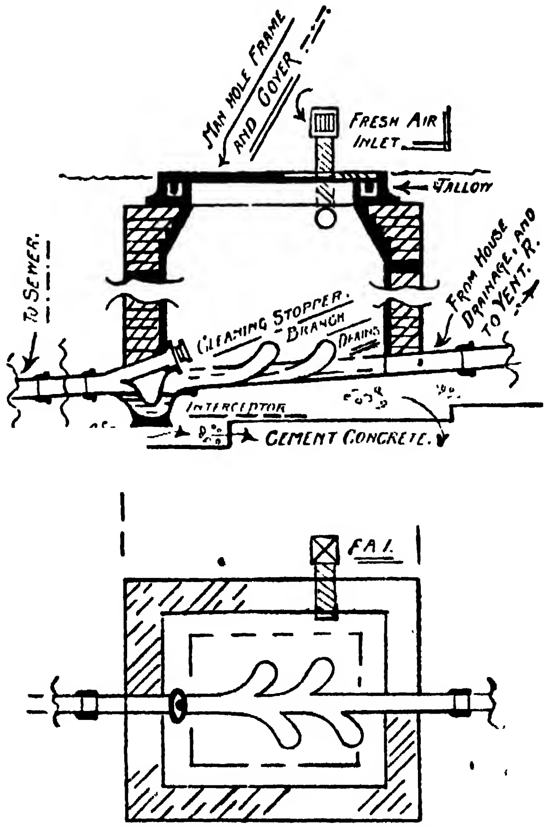


A SYPHON TRAP
The water in the trap (which may be P or S shaped) prevents gases from escaping into the house from the drain.

part runs away leaving solid materials to collect in the pipe. Iron pipes are used where drains may be subjected to ground surface pressures, or where for some unavoidable reason they have to be taken under a building. In the latter case they are buried in cement concrete.

All pipes discharging into a drain must be provided with traps ; that is to say a seal of water must constantly interpose between the inside of the drain beyond the trap and the air in the pipe or closet on the house side. This prevents the escape of foul air from the drain, which would be a source of danger to health in addition to the unpleasantness. Modern bye-laws enforce the employment of efficient traps in all cases, but it is not long since very quaint and wonderful things called traps were to be seen. The diagram on this page explains the principle of a simple syphon trap, the column of water in the bend being the seal which may be likened to a water cork, or plug. Gas on the distal (drain) side of the seal cannot pass to the proximal (house) side as the water closes the pipe. Water can, and does, absorb gases, hence if gas be present in the drain, as it practically always is, it will be absorbed into the water of the seal. Now this gas is, by its inherent power of diffusion, given off again on the house side of the seal, and we note its presence by the smell if the W.C. be not properly ventilated. No matter how well made the fittings may be it is always necessary to provide good ventilation in W.C.'s, which should have at least one outer wall. The soil pipe passes down until it joins the drain to which it is united by a gas-tight joint, hence we see the necessity of having a good protection against the foul air in the pipe. This is further assured by having the soil pipe carried up to a point above the roof so that any gases have a free escape there, the end of the pipe being open except for a protecting cage of wire which prevents the entry of birds.

The drain pipe itself opens into a specially constructed and ventilated chamber, called a disconnecting chamber, before it leaves the premises. This is to facilitate clearing the drain in case of blockage, and also to establish a complete break between the drain

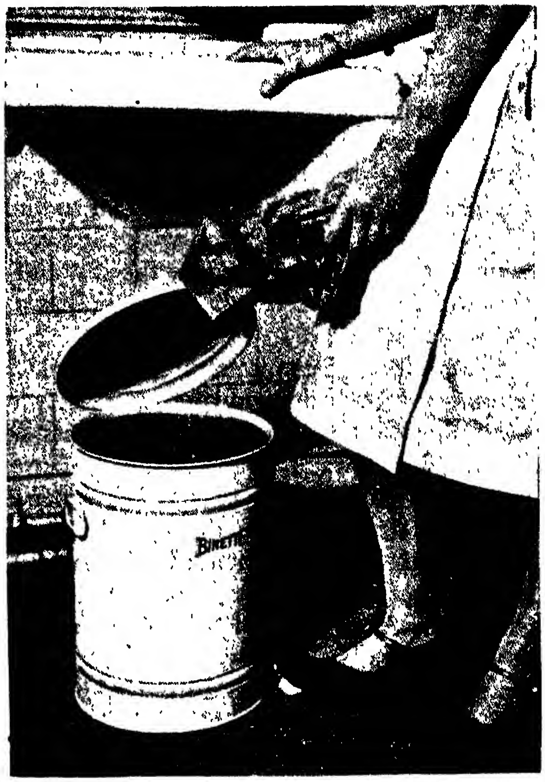


THE DISCONNECTING CHAMBER
The specially constructed and ventilated chamber between the house drain and the sewer. *Above :* in section ; *below :* a plan of the chamber.

and the sewer so that the risk of sewer gas (which is lighter and at greater pressure than the outer air) finding its way into the house may be reduced to a minimum. The lavatories, bath and kitchen sink, discharge their waste into open gullies protected by removable grids to intercept solid materials. Below the grid a water seal trap prevents the escape of gas, just as in the case of water closets. These gullies should be of glazed ware or metal, and require attention from time to time.

THE DUSTBINS.

Dustbins should be provided with covers, and the covers should be used for their purpose. Generally one sees the cover partially displaced, thus flies have access to the contents, from which they transport countless micro-organisms to other situations; hence the obvious risks of food contamination and personal contact. Wasps are even worse, since they have a decided partiality for offal, and as they are vigorous and resentful and do not hesitate to plunge into food while it is being eaten, they are more difficult to deal with. Their capacity for inflicting painful and dangerous injuries is not to be lightly counted. They are supposed to be destructive to flies. Doubtless, they do kill a few, but they are very clumsy executioners, and do not give much trouble to the fly population as a whole. Much vegetable refuse as well as some animal matter, is thrown into the dustbin which could be consumed in the kitchener, thus lessening the volume of putrescible litter with its attendant evil odours. In hot weather these heaps of dirt quickly become offensive ; therefore the need for frequent scavenging is greater in summer than in winter, but the call for efficient service is always urgent.



A HYGIENIC DUSTBIN
A dustbin with a lid which automatically opens when the pedal is pressed.

A useful accessory to the dustbin is found in a light wire sieve with meshes about three-quarters of an inch across. If all the house ashes are passed through this the incompletely burnt coal which remains behind in the sieve will provide useful contributions to the fire from time to time. All used and wet tea leaves should be put into the bin on top of the dusty refuse, thereby preventing the latter from being blown about.

HEATING AND LIGHTING

HEALTHY FORMS OF HEATING

By P. L. GARBUTT, A.I.C., First-class Diploma in Household and Social Science, King's College for Women.

HOW best to warm the house is a far more difficult problem to solve nowadays than it was twenty or thirty years ago when choice was considerably more limited. It is now possible for the heating to be by means of open fires, closed combustion stoves, hot-water radiators, as well as by gas, electric and oil heaters, etc., and before passing to a brief discussion of these different methods it may prove helpful to consider what constitutes healthy heating.

Everyone knows that certain forms of

heating are far more pleasant than others, and it is interesting to know that these are, as a rule, also the most healthful. They include those depending largely on radiation or, in other words, heat transference by direct rays from the source of heat, the air itself remaining relatively cool. This method of heating can be compared with the way in which the earth is warmed by the sun and it is therefore the one to which our bodies are naturally adapted.

Other less pleasant and less healthful heating methods depend almost entirely on what physicists term convection currents, the air itself being warmed and rising, colder air taking its place and in turn being warmed. A disadvantage of the air itself becoming too warm is that the normal heat-regulating mechanism of the body is interfered with, while the heated air readily absorbs moisture and has a very drying effect, absorbing moisture from the mouth, throat and nose of individuals in the room. The old-fashioned type of gas fire heated to a large extent by convection currents, and many people tried somewhat ineffectually to remedy the drying effect by placing small bowls of water in front of the fire.

In addition to seeing that the heating is brought about mainly by the process of radiation, it is also of great importance to see that all fuel burning stoves are fitted with a flue to remove the products of combustion. The provision of a flue also aids ventilation since the used heated air passes up the chimney as fresh air is drawn into the room.

All fuels consist largely, and in some cases almost entirely, of carbon, which, when burnt in the presence of air, takes up oxygen, forming the gas carbon dioxide. If burning takes place with an insufficient supply of air, there is the slight possibility that traces of the exceedingly poisonous gas carbon monoxide may be produced. Many fuels, notably coal, gas, paraffin oil, wood, coke, etc., also contain varying proportions of hydrogen and when this burns it combines with the oxygen present in the atmosphere to form water vapour.

From this it will be seen that as a result of burning fuels various products, including carbon dioxide, water vapour, and possibly traces of carbon monoxide are formed, while when certain fuels are not burning completely, smoke, soot, etc., are also often present amongst the products of combustion.

A GOOD METHOD OF HEATING

A dining-room with hot-water radiators, and a gas fire which can be lighted at meal times.

Although few people would for one moment consider the installation of a stove or grate burning solid fuel unless a flue were provided, there are many who, because the products of combustion are invisible, have no hesitation in installing a flueless gas heater. It can scarcely be too strongly emphasised that although invisible it is most desirable to remove these products and to

[General Electric Co., Ltd.

THE MODERN FIREPLACE
An electric fire which glows and flickers like burning coal.

avoid allowing them to accumulate in a room. Although carbon dioxide in very small quantities and water vapour are not poisonous, increase of moisture in particular is most undesirable, and, quite apart from the slight danger of the possible presence of carbon monoxide, on no account should a gas fire be fitted without a flue. The products of combustion of oil are very similar, and, as the provision of a flue is not as a rule very practicable, such heaters are only suitable for occasional use and should not be used in a small ill-ventilated room. The public-spirited man will consider the question of heating from the point of view of his neighbour as well as of the individual and for this reason will select smokeless fuels as far as possible. This is specially important in large towns and cities where pollution of the atmosphere by smoke is a very real menace to health.

Coal Fires. While bearing in mind the advantages of smokeless fuels, many still cling to one open coal fire of the ordinary type for the main sitting-room, and there is no doubt that many people consider no other form of heating so cheerful. The efficiency of modern open grates is considerably greater than that of the old-fashioned variety, while in addition, since metal parts are entirely omitted in the majority of cases very little cleaning is required.

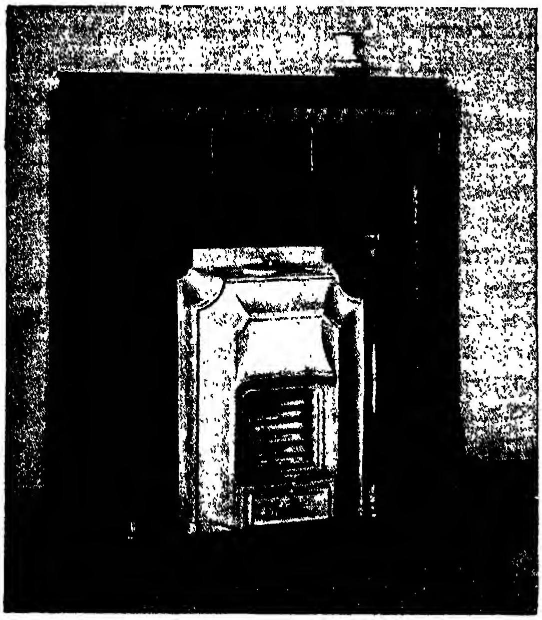
In the case of solid fuels there is little likelihood of a flue being omitted, and most of the modern stoves are built largely of firebrick, and can be relied upon to heat chiefly by radiation. In the case of coal fires, however, there is the disadvantage already mentioned that smoke is set free into the atmosphere. Although this may not be so important in the country house it is a great disadvantage in towns. Those who find it more convenient for various reasons, perhaps especially for economy, to use a solid fuel may possibly be interested to know that there are now various stoves on the market designed to burn coke, a smokeless fuel, and yet give a cheerful open fire. Anthracite stoves are another alternative, but with these there is the disadvantage that an open fire is not as a rule possible. There is a stove now on the market which can be used either as a closed combustion stove or when desired as an open fire. When closed either coke or anthracite can be used, but when open ordinary household coal should be used either alone or mixed with the other fuel.

Central Heating. The installation of radiators supplied with water heated by a coke-fired boiler is undoubtedly the most economical way of heating a large building. The disadvantage is, however, that the

heating is very largely by the process of convection to which reference has already been made. For this reason, it is usually considered wise from the point of view of health only to instal radiators with sufficient radiating surface to raise the temperature of rooms to 50° or 55° F. relying on other forms of radiant heating, such as that supplied by an open coal fire, gas fire or electric radiator, to raise the temperature further. This is specially desirable in the case of sitting-rooms and other rooms, such as school class-rooms, which are used continuously for many hours daily.

Gas Heaters.

Of other forms of heating, gas is possibly the most popular. It has many advantages; the stoves are clean in use and lighted in a moment. Modern stoves provided with upright fire-clay radiants, unlike the old-fashioned ones, heat mainly by radiation, and when provided with a flue must be regarded as a particularly healthful and clean way of heating the house. Those who consider these stoves unhealthy and therefore unsuited for such rooms as the nursery, may be reassured in this respect. It is, however, important to point out that all fires in which the flames are distorted by special fuel or in other ways should be strictly avoided, for with a bunsen burner such as is used in the modern gas stove, there is always fear of the formation of traces of carbon monoxide in such circumstances. This is particularly the case with those fires designed to simulate a coal or coke fire. Some fires of the same type, however, are perfectly satisfactory, as ordinary fire-clay radiants are provided underneath the special fuel thus ensuring that the flames are in no way distorted.



[Smith & Wellstood, Ltd.

A SITTING-ROOM STOVE

Anthracite is consumed in this type of continuously burning stove, which can be used either open or closed.

A gas fire provided with seven or eight burners is suitable for warming a room of average size and consumes about 30 cubic feet of gas per hour when full on. The cost with gas at 4*s.* per 1000 cubic feet thus averages 1½*d.* per hour. If used continuously such fires are of course rather dearer than a coal or coke fire, but being turned on or off as required the cost of heating a dining or other room which is used only occasionally during the day is not likely to be greater than that of a coal fire, besides being considerably more convenient.

Oil Stoves.

Oil stoves have their special uses as portable fires, but those who are particularly anxious to ensure that the form of heating adopted is entirely hygienic are recommended to observe special precautions when using heaters of this type. Thus, such a stove should only be used in a well-ventilated room, and it should be placed either immediately in front of the fireplace or in front of the window, in order that the removal of the products of combustion may be facilitated. A stove of average size burns about half a pint of oil per hour.

Electric Stoves.

Since they do not actually burn fuel, as in the case of the other stoves discussed, electric heaters require no flue and are therefore a very convenient form of portable stove. Moreover, the majority have the advantage of heating mainly by radiation, which, as previously mentioned, is specially desirable. The main disadvantage of an electric radiator is that, unless the rate paid for current is comparatively low, the cost of running is apt to be

rather high for continuous use. They are, however, ideal for use as occasional heaters, as for warming a bedroom, dining-room, etc. The current consumption of a stove suitable for warming a room 12 to 15 feet square averages 2 or 3 units per hour.

In addition to the ordinary variety of radiator, low temperature heaters are also available in the form of heated screens. These are convenient for local heating or when it is only necessary to raise the temperature of a room to a comparatively slight extent.

RADIANT HEAT

By C. W. SALEEBY, M.D., Ch.B., F.R.S.E., F.Z.S., Chairman of the Sunlight League; Author of "Sunlight and Health," etc.

WE all tend to lose our sense of proportion in the presence of surprising and triumphant new discoveries, especially—alas!—when they are of an artificial kind. No one who has lived at Leysin, in summer and in winter, could possibly be deluded into believing that only the ultra-violet rays of sunlight are valuable. Professor Rollier's prescription is *the whole sunlight on the whole skin.* Nothing has yet been achieved by ultra-violet rays alone, however intense and however skilfully applied, that remotely compares with the results achieved by whole sunlight. Evidently, therefore, we had better look a little more judicially at the spectrum—the spread out notes—of the sun's radiations and perhaps we shall discover as much interest and value in other notes—or wave-lengths—as in those which have lately become almost an object of idolatry.

By means of a very delicate thermo-electric method, Professor Sonne, of the Finsen Institute in Copenhagen, showed that the *visible* red rays of light have the remarkable property that they pass through the skin, and the walls of the tiny blood vessels in the skin, and are absorbed by the blood itself. Further, this property is shared by those rays which lie *immediately* below the visible red, and which are therefore called the infra-red rays, the "dark heat rays."

If the sun did not send our earth these heat rays, our planet would be far too cold to maintain our lives, and the visible and ultra-violet rays which reached it would be of no avail. Now, just as the most remarkable properties, *for our bodies*, have been found in ultra-violet rays—as that they make vitamin D in the skin—so the most remarkable property *for our bodies*, has been found in the infra-red rays; that they warm the blood without scorching the skin. They pass through the skin, instead of being stopped by it and heating it, and it is not until they reach the *blood* that they are stopped and absorbed. There is a special natural relation, therefore, between *sun* heat and the blood of man. And we see, evidently, that sun heat and sunlight are real skin foods. There are no others.

Skin Foods.

In 1924, was founded the Sunlight League, of which Queen Alexandra graciously consented to be the patron. We then believed and we believe to-day, in the whole sunlight, not in ultra-violet rays alone. That belief was and is fortified by the work of Sonne in Copenhagen on the special affinity between solar heat rays and our blood, and by the fine work on the same lines, and leading to the same conclusions, which has been done in Hampstead by Professor Leonard Hill, F.R.S., under the auspices of our committee on Light. But no one can really appreciate the value of such work, nor see where it leads us, who has not grasped the *theory of fever*, which must therefore be briefly stated here.

The physicians of the past thought fever an evil and sought to reduce it. Late in the nineteenth century, powerful drugs which can reduce fever were prepared from coal tar. They were widely used, with deadly results. To-day we know that fever is part of the body's means for self-defence. In the *warmed* blood defensive chemicals can be more quickly prepared; the fighting cells multiply and are more efficient. One of the most startling of recent discoveries consists in the deliberate production of fever (malarial fever) which in numerous cases cures a disease, general paralysis, never previously cured. But, as every one knows, fever has many unfortunate

Fever.

consequences. How excellent it would be if we could, so to say, warm the blood and yet keep the body cool! This seeming impossibility is achieved in large measure, as Sonne has shown, by the heat rays of the sun; because they specially seek the blood and are absorbed by it, rather than by the skin or any other tissues. This is exactly what we want, and is probably a very important part of the explanation of the value of sunlight in the cure of many chronic infections, from tuberculosis downwards. Ultra-violet rays have somehow managed to capture the entire brain-space of nearly all who have been drawn to this subject in the last five years. Now the time has come to get a saner, more balanced and therefore more useful view of the subject. We need infra-red rays, no less than ultra-violet rays, and we must have them.

Gas Fires.

Our present method is to burn coal. This wastes our principal natural resource, pollutes the air, destroys our noblest architecture, and, above all, obstructs the light of life—the ultra-violet rays most of all. Certainly a good coal fire may give us pleasant radiant heat, but its disadvantages and its cost in terms of disease condemn its use. Electricity is costly in the production of heat, and an electric radiator does not ventilate a room. The great use of electricity is in the production of ultra-violet rays. There it has no rival. But for infra-red rays we must turn to gas and use the familiar gas fire. But we all know that we often fail to derive the acme of *comfort* from a gas fire, even though it may be keeping us warm. It is liable to dry and scorch any skin surface that may be exposed to it. The infra-red rays of the sun are much pleasanter.

The reason for this difference has now been discovered; and the discovery links itself admirably with the findings of Professor Sonne in Copenhagen six years ago. As ever, what is best for us is exactly what Nature provides for us. In the ultra-violet region we learn that there are three ultra-violet octaves producible, but the sun only sends us the first *half*-octave. When we construct artificial lamps they are liable to send us ultra-violet rays higher still in pitch, further from the visible octave, and these cause our skin to itch and desquamate (scale and peel), and are evidently not so suitable for it as that half-octave sent us by the sun.

Similarly in the infra-red region, the rays that are best for us, the rays which pass through the skin without overheating it and causing us immediate pain and subsequent symptoms of burning, are the rays nearest the visible octave, the infra-red rays next the red. This exactly corresponds, we observe, to the case in the ultra-violet region. When we produce infra-red rays which are too long, too low in pitch, they scorch and hurt and are not pleasant; they are stopped by the skin, instead of going on to warm the blood.

"Radiants."

Exactly, therefore, as the clever electricians try to make artificial sunlight lamps which shall not produce ultra-violet rays of too high pitch, too short, and not suitable for our skin, so the clever students of radiation by means of gas have been at work for several years in the hope of producing a gas fire which shall send us the shorter rather than the longer infra-red rays. The problem was to make "radiants," as those clay objects in the front of a gas fire are called, which shall produce, when heated and made luminous by the combustion of gas, a radiation more like that of the sun than gas fires have produced hitherto. This object has been achieved. The result has been demonstrated to many students of this important and fascinating subject, including Professor Leonard Hill and myself. Simple personal experiment shows that, for instance, one can expose the delicate skin of the inner side of the forearm perhaps twice as long to the new radiants as to the old; because the scorching rays are relatively scarce and the blood-warming rays, those nearest the visible red, are relatively numerous in the new type of radiation. It is very noticeable that one can relieve local pains, such as those called rheumatic in the knee, or the pains of tennis-elbow and so forth, by local exposure to the new radiants, because one can get enough of the heat into the *blood* of the affected part before one burns the *skin* over it.

Perhaps the best part of the whole story is that the new " beam " radiants, as they are called, can be fitted into gas fires of any make, they cannot be patented, and they cost no more than the old radiants—of which, doubtless, the last will soon be made.

THE DOMESTIC SMOKE PROBLEM

By Professor J. B. COHEN, Ph.D., D.Sc., F.R.S., Formerly Professor of Organic Chemistry at the University of Leeds ; Member of the Local Government Board Committee on Smoke Abatement.

THE problem of domestic smoke abatement is confronted with difficulties which do not apply to factory smoke, yet domestic smoke is far more deleterious in its effects than the factory product. And this difference is determined by its mode of production. The burning of coal in an open grate is a process consisting partly of slow combustion and partly of destructive distillation, that is to say, owing to the comparatively slow rate of burning, some of the coal distils unburnt and, like the coal in a gas retort, produces unburnt gas, tar as well as solid carbon, which pass up the chimney and into the air.

Soot.

That the soot from a domestic fireplace is saturated with tar is readily observed under the microscope, when the drops of sticky material can be seen clinging to the solid carbon. The following are the analyses of soot from the same house-coal burnt in a boiler furnace and in an open grate :—

ANALYSES OF SOOT

Constituents.	Original Coal.	Open Grate.	Boiler cl	
			Bottom.	Top.
Carbon ..	69.30	40.50	19.24	27.00
Hydrogen	4.89	4.37	2.71	1.68
Tar ..	1.64	25.91	0.09	1.14
Ash ..	8.48	18.16	73.37	61.80

These figures are instructive, as showing that about a quarter of the total weight of domestic soot consists of tar, whereas the amount of tar in that from the boiler chimney is almost negligible. On the other hand, the increased draught of the boiler furnace carries up fine particles of mineral matter or ash in considerable quantity.

" RADIANT " HEAT
One of the new gas fires which give off short infra-red rays from the clay radiants.

The reason that domestic soot is so deleterious is obvious. Its tarry content renders it adhesive, and the permanent blackening of foliage and tree trunks, brick-work and masonry, fabrics and woodwork, and, in short, everything with which it comes in contact, is readily explained. Tar, as we know, is not removable by rain, and the steadily increasing discoloration of buildings and vegetation in and near towns is therefore mainly due to domestic smoke.

Factory smoke, on the other hand, consisting, as it does, mainly of mineral matter or grit and unburnt carbon, is readily washed away by rain. This is a matter of great importance. But there is another point to consider, namely, the *quantity* of domestic smoke. Careful estimations have proved unquestionably that something like 6 per cent. of the coal burnt in an ordinary fire-place passes up the chimney as soot.

Now, about 40 million tons of coal are used for domestic purposes, and thus about a quarter of a million tons of good fuel is wasted. Not only is it wasted ; it contaminates the atmosphere, and to that extent impairs the health of the community who have to breathe it. But that is not all. The waste is not merely that of fuel. It represents a waste of those valuable by-products, the tar, gas, and ammonia liquor ; the tar which is so important for the colour industry and for the manufacture of synthetic drugs, and the ammonia which is widely employed in agriculture as a fertiliser and for other purposes. Add to this the expense of washing and we shall realise the enormous cost which the smoke nuisance from domestic chimneys entails.

How is this smoke problem to be solved ? The solution is a simple one. Coal cannot be burnt in an open grate without the production of smoke. Raw coal for domestic use must then be eliminated. But there are three kinds of smokeless sources of heat available, namely, gas, coke and electricity. Leaving on one side the use of electricity, the installation of which may be too costly, we will confine our attention to coke and gas.

Warmth Without Smoke.

Gas both for heating a room and for cooking is far more efficient than coal. A gas-fire will radiate something like half its total heat of combustion into the room, while the radiation from a coal fire may be estimated roughly at one quarter, the remainder of the heat passing up the chimney, where it is partly absorbed by the brick-work and partly escapes into the open air. That is the reason why a room warmed by a gas fire is liable to become overheated and produce the sensation of dryness of the skin (due to increased evaporation from the skin at the higher temperature), which some people try to correct by placing in front of the fire a dish of water, from which the moisture passes directly into the flue, instead of *above the fire*, so as to allow it to pass into the air.

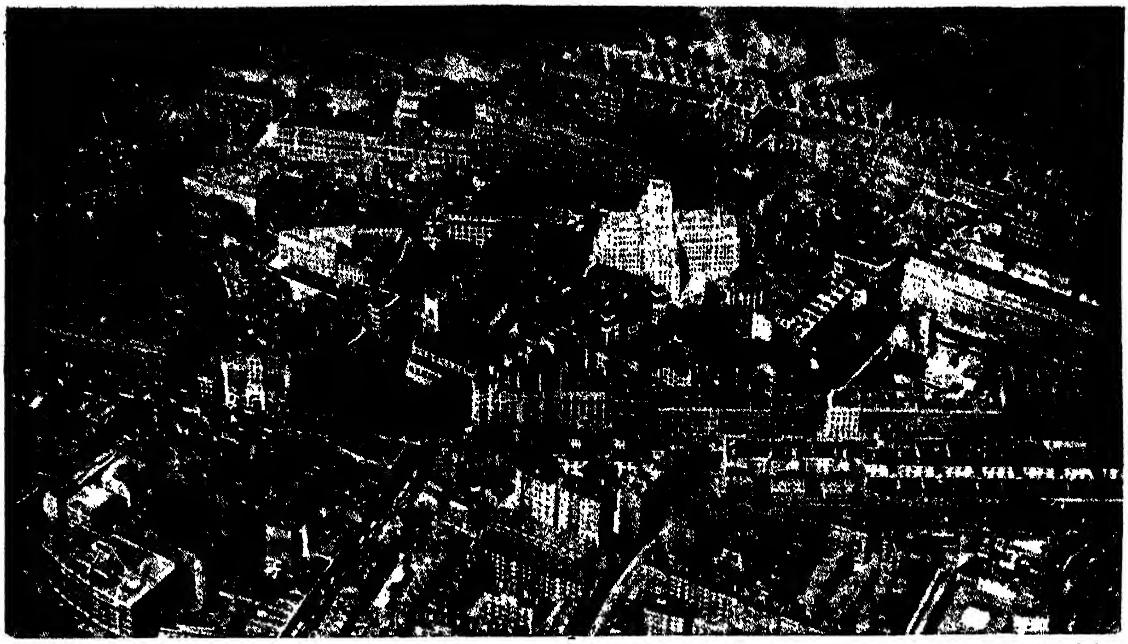
Gas.

Provided that the gas fire is so installed that there is a free current of air up the chimney, ventilation is quite as effective as that produced by a coal fire. A gas fire is therefore an efficient and entirely hygienic system of heating. But a gas fire is more costly than a coal fire, even allowing for the fact that it is easily ignited without paper or chips, that it can be shut off at once when not wanted, and that it saves the labour of carrying coals, cleaning, etc.

Undoubtedly the most economical and effective method of heating a room is a coke fire. Coke is, as a rule, or should be, cheaper than coal. If the fire-place is built of stout fire-brick, with a fairly capacious bed and a forward-sloping back, coarsely broken gas-coke not only burns well, but also gives a much hotter fire than coal. It is, of course, necessary to start it with a little coal ; but once started it needs no more attention than a coal fire, though an occasional clearing of the bottom bars from ash with the poker is desirable.

Coke.

It is in this direction that the gas-undertakings might play, if they chose, an important part. Gas-coke is the material left in the gas retorts after the gas, tar, and ammonia liquor have been removed from the coal. It consists mainly of carbon, but varies much in quality and in size. Both quality and size are



[*Aerofilms Ltd.*

THE EFFECT OF SMOKE ON BUILDINGS

The new Underground Railway building at St. James's Park, London, in striking contrast to the smoke-blackened buildings around it.

important in domestic use, and it is in this respect that the gas works can help in eliminating domestic smoke. The coal before coking should be washed free from dirt, so that the ash content of the coke made from it should not exceed about 8 per cent. Moreover, it should be graded, and pieces of approximately 2 to 3 inches in diameter separated from the smaller-sized pieces and from the breeze (the finer particles and dust). Finally, the coke should be sold at a low price which a steady home demand should easily ensure.

It is sometimes forgotten by the gas undertakings that they are public services and that their first duty is to supply the public with fuel at the lowest possible price. Not uncommonly they regard themselves as business undertakings which have to show the largest possible profit. It is by working on this false basis that a high price of coke abroad will divert the material from home and raise the price to home consumers. There is another point which is sometimes overlooked. The gas undertakings, as a rule, pay great attention to inducing customers to use gas by installing attractive showrooms with gas fires, gas cookers and the latest thing in gas mantles for illumination. What do they do to promote the use of coke? Little or nothing.

Coke of a certain size and quality can be burnt in a properly constructed grate of firebrick. But coke of a rather smaller size can be and is largely used for heating water in water-jacketted boilers, which give an unlimited supply of hot water. Many of them are provided with rings on the top for frying or boiling, and doors which open and throw a pleasant glow into the room. These various coke appliances should, I maintain, share the showroom with the gas fires and cookers, and full information as to their cost and efficiency should be placed at the service of would-be buyers as in the case of gas appliances.

Coke Boilers.

For it must be remembered that people, and more especially housewives, are difficult to persuade when it is a matter of changing a traditional system with which they have grown up. The only way, to my mind, is to have the apparatus actually working. There are open coke fires, open coke fires with back boilers and with water-jacket boilers, and so forth. If the intelligent housewife could see

these things, realise their economy, efficiency, and cleanliness, and be reminded at the same time of the benefit she was conferring on others, as well as on herself, by maintaining a clean atmosphere, there would be few who could not be persuaded to replace the whole of their raw coal by one or other of the smokeless fuels, but especially by gas and coke.

When one considers the dirt, the grime and discomfort, the absence of sunlight, the effect on health of the cutting out of ultra-violet rays, which are absorbed by the smoke cloud, and, lastly, the heavy cost in waste of fuel, destruction of vegetation, disintegration of building stone (a direct result of smoke), and in washing and painting, an outlay of several thousands of pounds would be well spent if only one-half the present emission of smoke were thereby suppressed.

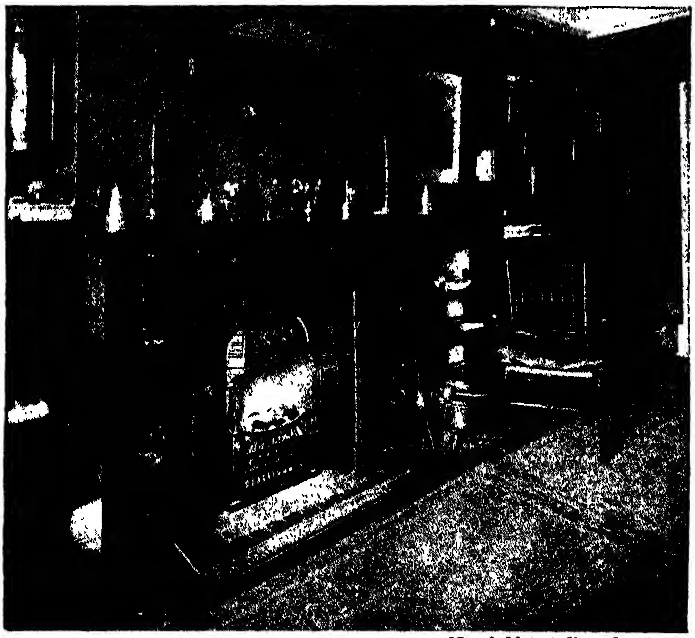
LIGHTING

By P. L. GARBUTT, A.I.C., First-class Diploma in Household and Social Science, King's College for Women.

NEEDLESS to say natural lighting is the ideal and daylight should be utilised to the fullest extent possible. When building a house care should be taken to ensure that the window areas are sufficiently large for all the rooms to be well lighted. In a house already built in which the lighting in some of the rooms is poor, much can be done to lighten rooms by keeping the walls and paintwork a pale colour. If the rooms are dark because of nearby buildings or a wall which obstructs the light, the lighting can often be improved considerably by fitting prismatic glass. This glass has a ribbed appearance and is supplied in various grades having prisms of different angles. When ordering it is important to specify the angle of incidence of the light, so that the correct glass may be supplied.

Ordinary window glass has the disadvantage of cutting out the ultra-violet rays. These are of course particularly important with regard to the health of sedentary workers, children, invalids and any others who are obliged to spend many hours of the day indoors. It is well worth considering replacing the ordinary glass by the special Vita glass. This allows the ultra-violet rays to pass through, and tests carried out in connection with the use of this glass in schools and elsewhere have shown conclusively that very definite benefit to health accrues from its use. This special variety of glass is naturally rather more expensive than ordinary window glass, and thus there may be many who would not feel justified in fitting it throughout the house. In such cases it is suggested that it be fitted in the nursery and in the main sitting-rooms. Special sunlight or ultra-violet ray electric lamps are also available for home use but these should only by used under medical superintendence.

Means of artificial lighting have advanced considerably during recent years, but where available there can be no doubt that electric lighting is the most favoured method.



[South Metropolitan Gas Co.

A SMOKELESS FUEL

An open grate for burning coke—an economical and effective method of heating.

[General Electric Co

MODERN ELECTRIC LIGHTING
Showing several useful positions and fitments for bedroom lights.

Electric Lighting.

In electric lighting there are various fundamental points which should receive most careful consideration. Thus special care should be taken to avoid glare, to ensure that the lighting is sufficient and that the various fitments are placed suitably and are adapted to their particular purposes. The special advantages of lighting by electricity are that it is clean in use, there being no products of combustion, while it requires practically no labour and, in addition, its cost is low. Thus, for example, a 60-watt lamp will give between 16 and 17 hours' light for the consumption of one unit, the average cost per hour, with electricity at 6*d.* per unit, being one-third of a penny.

When building a house it is obviously most important to go very thoroughly into the question of wiring, and to see not only that there are sufficient points but that they are conveniently placed. There are two main types of lamp now available, viz., vacuum and gas filled. The latter are the most efficient and should be used for the main rooms of the house, while vacuum lamps are suitable for passages, lavatories, etc., where less brilliant illumination is required.

For sitting-rooms and others which are in use many hours of the day, it is especially advisable to avoid glare as far as possible, either by fitting lamps with white sprayed bulbs, or by using clear lamps in a fitting such as a bowl or enclosed unit, which ensures a well-diffused light. An advantage of this is that no shadows are cast, although it is true that a small percentage of the lighting power is lost. The strength or wattage of lamps required varies, of course, to a certain extent, according to whether the room is a sitting-room, bedroom, etc., and also whether the walls, paint, etc., are of a light or dark colour. In general, however, it can be taken that for sitting-rooms, the wattage should be equivalent to half or three-quarters of the floor area measured in square feet.

Of the other methods of lighting, gas lighting is, as a rule, preferred when available.

Gas Lighting.

Modern burners, mantle and other fittings make this a very different proposition from what it was twenty of thirty years ago, and to-day, for example, switches are frequently fitted near the door so that light may be switched on or off as conveniently as electric light. The fitting of such switches is by no means costly, the switch, tubing and fixing costing as a rule, less than £1. Modern burners are inverted, and the shades or bowl fittings supplied are designed to avoid all glare, the lighting being semi-indirect and thus casting no shadows.

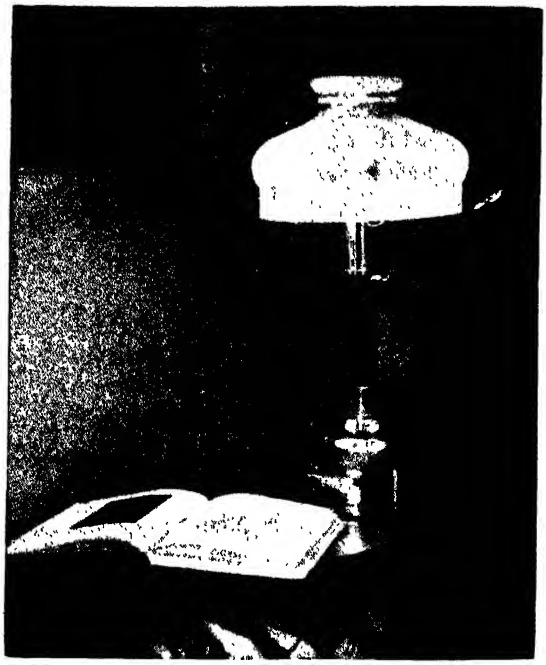
In addition to wall brackets and pendants

it is possible to obtain reading and standard lamps, very similar in appearance to those used for electric lighting and as easily controlled. In addition to the ordinary single burner and mantle, larger ones fitted with multiple mantles are also obtainable. These are designed for use in positions where a specially good light is required.

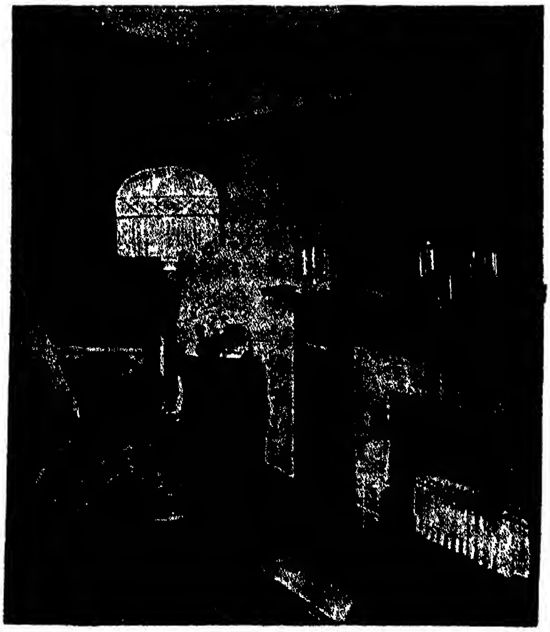
The cost of gas lighting compares favourably with other methods, a single 60 candle power burner consuming on an average rather less than three cubic feet of gas per hour. With gas at average rates the hourly cost is thus less than $\frac{1}{4}d$.

Other Systems.

The preceding methods of lighting apply specially to towns; in country districts portable lamps are still the usual means of illumination unless it is possible to instal one's own electric, petrol air or acetylene plant. Space does not permit of a discussion of the latter methods but it may be stated that in general small acetylene installations are the cheapest, petrol air plants being rather dearer and electric ones still more so. The advantage of a petrol air plant is, however, that it is also possible to use it for supplying heating and cooking stoves while with an electric plant labour-saving equipment such as vacuum cleaners, polishers, washing machines, sewing machines, etc., may be used.



AN OIL READING LAMP
A typical portable lamp fitted with a mantle.



AN EXAMPLE OF GAS LIGHTING
A gas standard lamp attached to a gas point in the drawing-room.

To return to the portable lamps, which are used by the great majority of country dwellers, these are now as a rule fitted with mantles and give a light of considerably greater candle power than did the old-fashioned wick varieties.

They are also much more economical, a well known up-to-date make of lamp consuming as little oil as half a gill per hour. Portable petrol lamps are being increasingly used and with ordinary care have been proved to be perfectly safe, although it is important to see that the petrol is not stored or the lamps filled in a room with a fire or naked light. In one well-known make of lamp the petrol is absorbed in a porous stone and thus there is no free petrol when the lamp is in use. In another, although the petrol is contained in a reservoir the lamp is actually extinguished in a minute or so should it become accidentally overturned. The petrol consumption of an average lamp is one-third of a gill per hour.

HOT WATER SUPPLY AND BATHROOM HYGIENE

By P. L. GARBUTT, A.I.C., First-class Diploma in Household and Social Science, King's College for Women.

In the modern bathroom, the question of how best to secure an adequate and constant supply of hot water is obviously one of such primary importance that it should be one of the first points to be decided when considering either the equipment of a new bathroom or the remodelling and bringing up-to-date of an old one.

Means of heating water are so numerous that it is small wonder that many find it difficult to come to a decision on this point. It may therefore prove helpful to discuss the various methods of supplying the bathroom with hot water, making an analysis of the more important types of heaters now on the market. These include ranges of various types burning coke, coal or anthracite ; gas and oil-heated geysers and circulators, and electric heaters, the last being mostly of the storage variety.

Coke-fired Boiler.

Where the cutting down of expense and the need for a lavish supply of hot water are both demanded, the householder would do well to consider the installation of a coke-fired boiler. Even the small models of these stoves will as a rule supply forty or more gallons of hot water at a temperature of 110° to 130° F. per hour, an amount sufficient for two good baths within an hour.

In the house of average size provided with only one bathroom, a greater supply than this will seldom be required, but in houses where the pipe runs are of more than average length, a rather larger boiler may possibly be required to supply the quantity of hot water mentioned above, for naturally heat losses from the pipes are considerably greater unless they are lagged. In other cases, a larger boiler is selected because it is desired either to run off one or two radiators or possibly a towel rail in the bathroom itself.

The fuel consumed by a small boiler such as the above obviously depends to a very large extent on the way in which it is stoked and the draught adjusted, etc. With ordinary care, however, the fuel should not be more than about 1½ to 2 cwt. of small grade coke per week, provided the draught is reduced and the fire banked up during the afternoons, and at other times when comparatively little hot water is required.

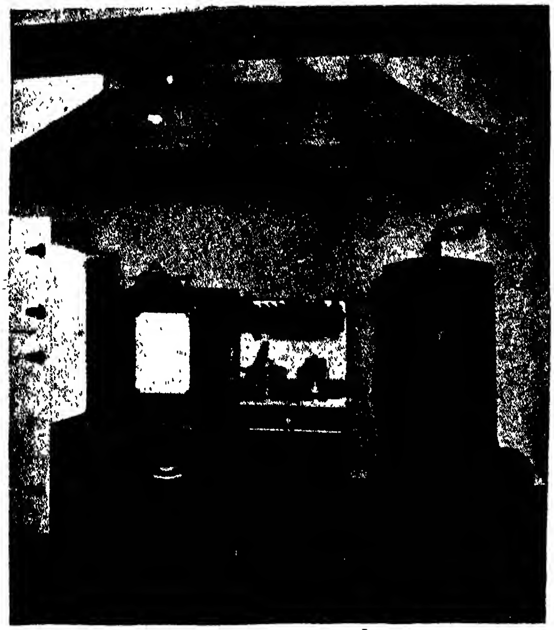
Combined Stove.

Especially perhaps in the country, where neither gas nor electricity is available for cooking, the popularity of the boiler is closely rivalled by that of the combined stove, which in addition to heating the water supplies cooking facilities. The efficiency of the modern stove of this type is immeasurably superior to that of its old-fashioned predecessor, which as a rule was a very wasteful piece of domestic equipment. For a consumption of 2 to 3 cwt. per week of a mixture of coke and coal or other fuel, small up-to-date stoves will supply ample cooking accommodation for a fairly large family as well as 2 or 3 baths per hour when required.

Modern stoves, such as the above, also have the advantage of giving good results when stoked either entirely or mainly with smokeless fuels, such as coke or anthracite. Especially where there are children in the family, either a coke-fired boiler or combined stove such as the above usually proves the most economical and generally satisfactory way of ensuring a constant supply of hot water at comparatively little cost.

Gas Water-Heaters.

In the case of a small household, or where reduction of labour is of even greater importance than economy, a gas or electric water-heater is recommended. Such heaters also prove useful in other households during hot weather, as naturally they do not warm the kitchen or room in which they are fitted to any appreciable extent. Gas-heated geysers are perhaps the best known, and in the case of reputable makes, their efficiency is particularly high, in many cases as much as 90 or even 95 per cent. of the heat generated being actually utilised in heating the water. The main disadvantage of this type of heater is that



A GAS WATER-HEATER
The water is heated continuously by a small jet, and stored in the tank until required.

unless specially large and relatively expensive appliances are selected, a separate one is required to supply each draw-off point.

As appliances of this kind heat water almost instantaneously as it flows through the apparatus, a comparatively large amount of gas is necessarily burnt while the geyser is actually in use. This makes the provision of an efficient flue to remove the products of combustion a question of vital importance, and on no account whatever should a gas geyser or similar type of water-heater be installed without this. Where it is desired to heat water by gas and supply several points, perhaps including the kitchen and fitted basins in bedrooms as well as bathroom, a circulator type of gas water-heater is as a rule preferred. This can be fitted in the kitchen and connected to the existing hot water system, and either used alone or only during the summer months, or, if desired, it can merely be used to augment other means of heating the hot water cylinder when there are specially large demands on the hot water supply.

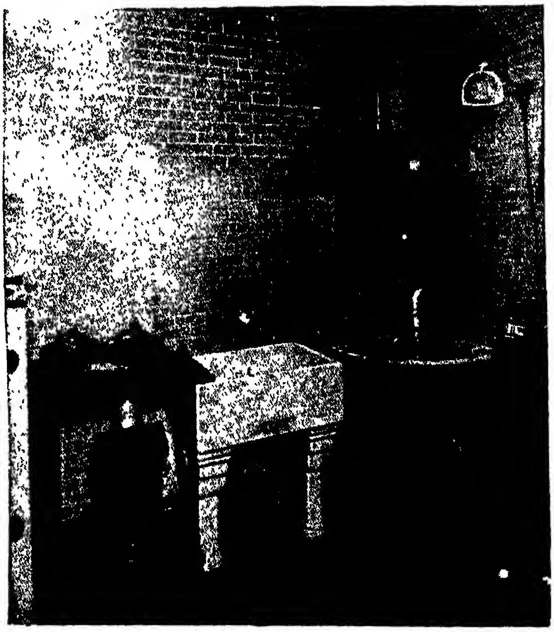
Water-heaters of more or less similar type to the above, but heated by oil instead of gas, are also obtainable and prove specially useful in country districts. The cost of heating water by this means is very similar to that of gas at average rates. With gas at 9*d*. per therm and oil at 1*s*. per gallon, the cost of heating a good bath averages 2*d*. or less in both cases.

Oil Heaters.

Especially where the provision of a flue is inconvenient, an electric water heater proves a good choice. Most of these are of the storage type, and heat a cylinder of water. Such heaters are convenient where the hot water requirements of the household are not too large, but where a very lavish amount is needed they are not so suitable, for as a rule once the whole supply in the tank is exhausted, the fresh water heats only comparatively slowly, and in some cases it may be necessary to wait several hours before a large amount is again available.

Electric Water-Heaters.

It is true that there are electrically heated appliances of the geyser type, but on account of the necessarily heavy loading, their use is limited, and in any case they can only be regarded as suitable for supplying a comparatively small amount of water, such as to



ANOTHER TYPE OF GAS HEATER
When a hot water tap is turned on, the gas in the heater above the copper ignites automatically, and an immediate supply of hot water is obtained.

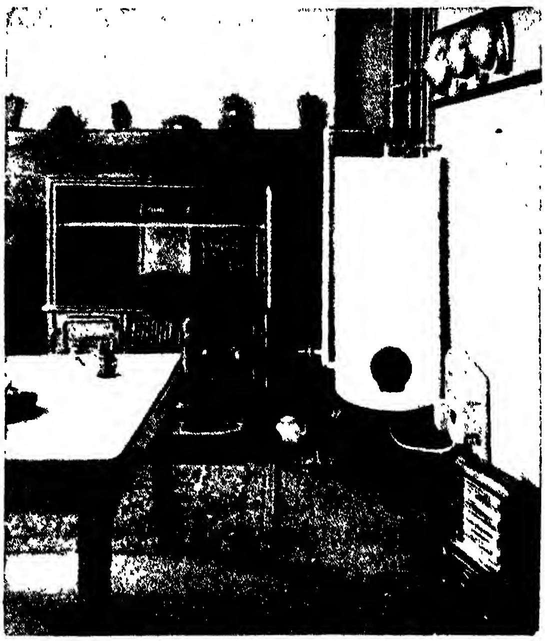
a lavatory basin or sink. The average cost of obtaining a good hot bath with electricity at 1*d.* per unit is 3½*d.* to 4*d.* On account of the somewhat high cost of heating water by this means, all heat losses should be reduced as far as possible, and the insulation of the hot water cylinder is specially desirable. In one heater at least which is now on the market, so efficient is the lagging that even when the water is practically at boiling point within the cylinder, the outside feels perfectly cold to the touch.

Wall and Floor Treatment.

Having decided on the most suitable and convenient way of heating the water, paying due regard to the special conditions of the household, the question of wall and floor treatment next requires consideration. Where there is no special need to reduce expenses to a minimum, there can be no doubt that a tiled wall is ideal. This is easily cleaned merely by rubbing over with a damp cloth and such a surface has the advantage of giving practically everlasting wear. Coloured tiles are, of course, the most expensive, as they have to undergo a further process in addition to those involved in the making of a white tile.

The cost of tiling with white tiles of first quality averages about 14*s.* per square yard at the present time, or 11*s.* to 12*s.* with second quality tiles. An alternative to tiling is either to treat the walls with an artificial tiling, such as the enamelled sheets of zinc now obtainable, or with paint or enamel. Provided a good washable make of enamel, etc. is selected, a hygienic, readily cleaned surface is obtained, which can well be used either for the entire wall surface or, if preferred, tiles can be used half-way up the wall and the remainder painted. In addition to painting the walls the ceiling should also, if possible, be painted or enamelled, as a whitewashed or distempered ceiling is always liable to peel in the steamy atmosphere of a bathroom.

For the floor, a good inlaid linoleum, a good make of composition floor, such as those made of magnesium chloride cement together with filling materials, or a rubber flooring are all suitable. Linoleum is likely to be the least costly, a good inlaid one being obtainable for as little as 4*s.* to 5*s.* per square yard. When making a selection it is wise both in the case of linoleum and rubber to avoid selecting one with a plain surface, a granite, marbled or jaspe pattern being preferable, as these show footmarks, etc., considerably less. In the case of a composition flooring, too much emphasis can hardly be laid on the necessity only to select one supplied and laid by a firm of repute, for the only remedy for an unsatisfactory flooring of this kind is to have it relaid, which, besides being costly, is as a rule very inconvenient.



[*General Electric Co.*

AN ELECTRIC WATER HEATER

The storage type of electric heater supplying all household requirements.

The junction of the floor and wall should, if possible, be coved, so that there are no corners to collect dirt. The coving can be a continuation of the wall surface, if this is tiled, or in the case of a composition flooring the edges of the flooring itself can be rounded. When selecting the sanitary fittings themselves, it is very important to see that these are of good quality if lasting wear is to be obtained.

The bath should be of good porcelain enamel, and when placing it care should be taken that it is possible to clean all round and under it, unless an expensive built-in porcelain model is selected.

The Bath.

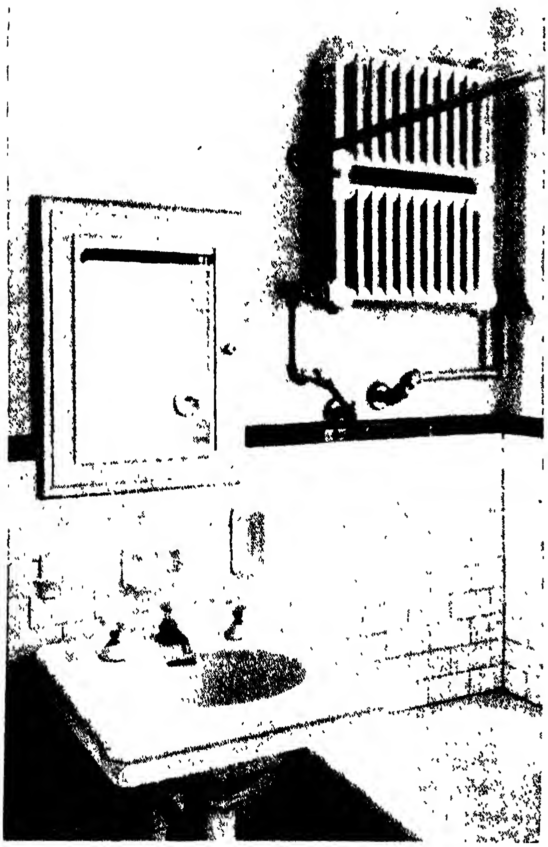
In order to keep such fittings in good condition, care in cleaning is demanded, all abrasive cleansers being avoided. A non-abrasive soap powder may be used, or, if preferred, the bath can be rubbed over with a cloth dipped either in turpentine or paraffin.

The taps and all other small fittings should be chosen with a view to ease of cleaning, either good porcelain, stainless steel, or heavily plated nickel being suitable. In the case of porcelain taps, etc., a daily wipe with a damp cloth is practically all the cleaning required, but care is needed to see that they are not knocked, for their only disadvantage is that they are liable to chip with thoughtless use. Nickel taps also require no cleaning, but should be rubbed over very occasionally with a slightly oily duster.

For lighting, if electricity is available, a totally enclosed unit should be selected, for with this an evenly diffused light is obtained, while the fitting itself is easily kept clean. For heating, a heated towel-rail or small radiator is usually sufficient. If, however, the bathroom is large, the provision of an up-to-date gas fire or electric radiator would provide any further heating required.

Lighting.

THE LABOUR SAVING HOUSEHOLD*



THE BATHROOM FITTINGS
A tiled wall is ideal, and porcelain taps, etc., are very easy to clean.

HYGIENIC BEDS AND BEDDING

By ELIZABETH EDWARDS, First-class Diplomas in Cookery, Laundry Work, Housewifery and Needlework; King's College Certificate in Household and Social Science.

A COMPARISON between the appearance of a four poster bed in full regalia and the modern bed with its extremely simple appointments, will show that the latter has every claim to be preferred on the grounds of hygiene.

When choosing a bed and its fittings, simplicity in design and general structure is most desirable; hangings, carvings, and such like must be regarded as so many dust traps. The greatest consideration should, however, be paid to the quality of the springs and mattress. These must be of the best type the purchaser can afford, as their condition and quality affect the position of the body during the seven or eight hours of each day which are devoted to rest or sleep. To ensure thorough rest the body should be relaxed and supported without muscular effort, and a well-sprung, resistant mattress supplies the support. On the other hand,

* See also section on "Home Disinfection and Sanitation," page 1054.

Courtesy] [Lord & Taylor, New York

THE MODERN BEDROOM

a soft, lumpy, and "sagging" mattress produces a faulty position of the spine and muscular effort is required to keep the body in position, so that on awaking the person is unrefreshed.

There are several types of springs and mattresses from which to make a choice. A spiral steel spring mattress, or a woven wire mattress, may be fitted to the bed frame, and on these an overlay mattress or an upholstered mattress may be used. In order to avoid rusting and soiling the mattress cover, the metal springs should be brushed over at the yearly spring cleaning with a solution of petrol and vaseline to prevent rust. It is, however, also desirable to cover the metal with a felt underlay which should be tied in position. In some cases a box spring mattress is fitted to the bed frame and on this the overlay mattress is placed. The box spring mattress contains spiral springs, and a layer of wool under the cover minimises the wear from the springs on the cover.

The upholstered mattress which contains spiral springs in addition to a filling of hair and a protective layer of wool under the cover, is becoming increasingly popular. It is adequately ventilated so that a current of air gains access and keeps the mattress fresh. It rests directly on the bed frame.

The various fillings used for the overlay must now receive consideration. Undoubtedly hair is the best substance for this purpose. It is resilient, easily ventilated, and it keeps in place without forming into lumps. Unfortunately the other fillings have less to commend them on hygienic grounds, although white wool is largely used and is very satisfactory. Kapok, and various composition fillings, do not allow of free ventilation, and owing to their nature they form into lumps and are not resistant. Feather beds must also be forcibly condemned on the above grounds.

Rubber as a material which is used in the entire construction of a mattress may sound

somewhat unusual. A mattress constructed of porous rubber with large air spaces and of a suitable thickness proves very comfortable and does not sag when the body rests on it. Up to the present it has proved resistant to tropical heat and to insects. It is suitably covered and provided with adequate means of ventilation.

Finally, whatever the type of mattress chosen, it should be durable, well finished and well tufted. Washable covers should be made for mattresses, pillows and bolsters to protect the ticking. All parts of the bed should receive thorough daily airing before an open window and in the sun when possible. The mattress should be arched to its fullest extent so that the air can circulate freely all round it. Repairs to springs and mattresses should be carried out when required. Periodically, mattresses, pillows and bolsters should be cleaned. Down is the most hygienic filling for pillows and bolsters, but feathers and kapok and other vegetable compounds are used.

Bearing in mind that the body requires muscular rest during sleep, it will be clear that heavy bed clothes must be avoided. The old-fashioned quilt, weighing several pounds, has fortunately gone out of fashion, and has been replaced by the ciderdown. This should be filled with down, for a comparison between eiderdowns filled with feather down and those filled with a vegetable compound will show a considerable difference in weight in favour of the former.

It is always worth while spending money on good blankets, as here again the all-wool blanket is verv much lighter in weight, as well as being " warmer," than a flannelette or so-called " wool " blanket. The materials used for sheets and pillow-cases can be chosen according to the means of the purchaser. Linen has largely gone out of use on account of its high price, but provided that it is kept clean, the quality of the bed linen is not material. Linen or a mixture of linen and cotton can, however, be kept a better colour than cotton.

The return to the bed with side drapings and elaborate hangings is the cult of the luxurious few, and the modern housewife prefers a bed to which air can have access and which can be kept free from dust with the minimum of labour.

THE KITCHEN SINK

By D. D. COTTINGTON TAYLOR, Director of the " Good Housekeeping " Institute.

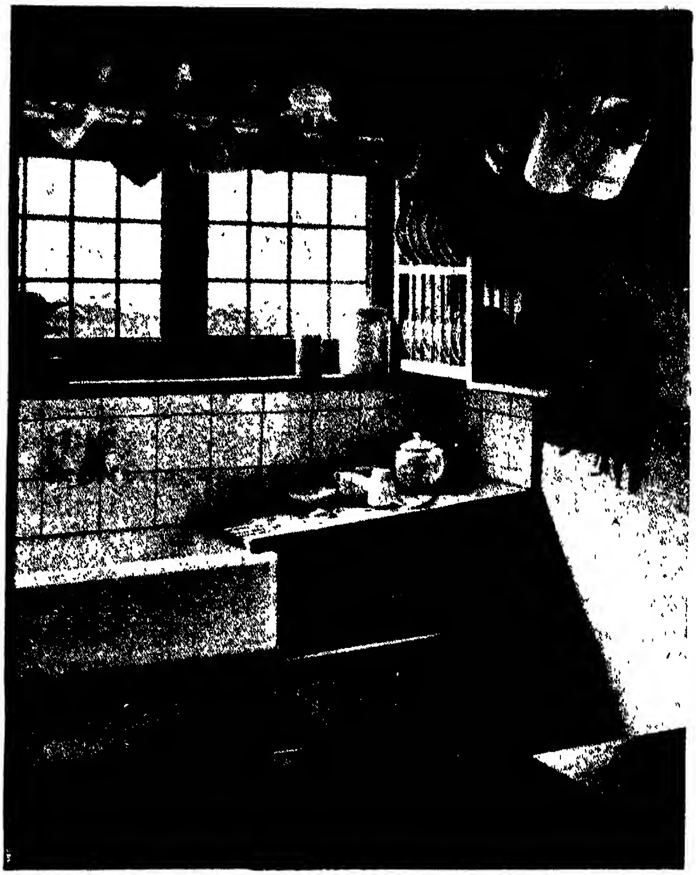
ALTHOUGH in houses of moderate size one sink only is provided, it is desirable, where space will permit, to have at least two, one being reserved for the cleansing of silver, glass and fine china, and the other for plates, dishes and general kitchen use.

In order to reduce building costs, many small post-war houses are provided with a combined kitchen-scullery, instead of separate rooms, but if the kitchen is limited in size and is used by a maid, or maids, as a sitting-room, it is preferable that the sink should be in a scullery adjoining. In the servantless house it is frequently found more convenient to have the sink in the kitchen within a few steps of the stove and table. Whichever is selected it is most important that the saving of steps, and thereby the conserving of energy, should receive very careful consideration. Those who are compelled to live in old-fashioned houses where the distance from the dining-room and kitchen to the wash-house or scullery calls for many weary journeys during the course of the day, should not hesitate to reduce the drudgery of kitchen work by altering the position of the sink and bringing it within a few yards of the cooking range and kitchen tables.

The situation of the sink in relation to the kitchen is not the only point which should receive consideration, for the height has much to do with the comfort of the worker. Until comparatively recently housewives gave little or no thought to the question of fatigue. This explains why almost every sink was set at such a height that it caused the worker to stoop unnecessarily and produced backache. It has been found that a distance of 36 inches from the floor to the top edge of the sink affords the greatest ease to the average

worker, although for a very short or particularly tall worker, the height would need a little alteration.

It is not reasonable to suggest that a sink should be altered to suit each user, but if it be fixed at 36 inches from the ground, a short worker can increase her height by standing on a thick fibre or slatted wooden mat whilst a tall worker could use a wooden sink board which would raise the wash-up basin or vegetable bowl several inches according to the thickness of the board.



Courtesy] [" Good Housekeeping "

THE KITCHEN SINK

A glazed fire-clay sink with tile surround and built-in draining board.

Glazed Sinks.

With regard to the choice of sinks, those of white glazed fire-clay or stoneware have much to commend them, for not only are they of attractive appearance and easy to clean, but being non-porous, dirt and stains cannot penetrate. Careless and thoughtless workers should, however, be warned against using abrasive cleansers unnecessarily, for anything of a gritty nature in time wears and damages the glaze, with the result that the surface gradually becomes less shiny and more effort is required to keep it in a spotless condition.

Sinks of glazed fire-clay with high backs supported by two strong white glazed standards, and the surrounding wall covered with glazed tiles, are ideal, for very little effort is required to keep such a fitting scrupulously clean. In large houses where a quantity of china has to be cleansed, teak sinks are sometimes preferred. The initial cost is greater than that of glazed fire-clay, and considerably more effort is required to keep them in a hygienic condition, but they have the advantage that there is little likelihood of breakages and chipping when the washing up has to be done hurriedly. This difficulty can be overcome when using stoneware sinks by providing large pulp bowls for the actual washing up of delicate china. Teak sinks are not generally lined as the wood is very hard and durable, but sinks made of softer wood are sometimes lined with copper, and more frequently with lead.

The chief drawback of unlined wooden sinks is the difficulty of finding workers willing to keep them free from grease, as they soon become sour and unpleasant if neglected. In some country districts unglazed stone and brick sinks are still found, but these, being porous, are not hygienic and should therefore be replaced with as little delay as possible.

The Taps.

The taps should be fixed at such a height from the floor of the sink as to permit a tall pail or water can to stand upright. Such a point may at first appear trivial, but only those who have used a sink with taps fixed low can appreciate the

petty annoyance and inconvenience it occasions. It is hardly necessary to mention that splashing is caused if taps—particularly the rain tap—be positioned unnecessarily high.

Both hygienic and labour saving are taps of white porcelain enamel, as a wipe with a damp cloth is sufficient to keep them spotlessly clean. Unfortunately the enamel is liable to chip if used carelessly. Therefore in the average house they are specially suitable for bath and lavatory basins, but nickel plated taps, which are less expensive, should be selected for kitchen and scullery, where workers are liable to knock them when filling pails, pans, etc.

Special paint and lacquer are obtainable with which brass and shabby nickel plated taps may be treated to obviate constant cleaning. The results obtained are fairly satisfactory but naturally not of a very permanent nature, as any surface application wears off objects which are used frequently.

Draining Boards. If space permits, two draining boards of adequate size should be provided, one on either side of the sink. Such an arrangement simplifies the oft-repeated task of washing up very considerably, for the dirty things can then be packed on the right-hand board, washed up in the sink, and drained on the left. If for some reason "built-in" draining boards cannot be accommodated, the inconvenience can be overcome by providing clip-on boards. These prove very useful in a small scullery when the sink is immediately next to a clothes boiler (a very common arrangement in modern villas and bungalows) for they can be removed when not in use.

Washing Up. To some it may appear that there is nothing to learn about the prosaic task of washing up. On the contrary, the oft-repeated job is frequently so badly done that it is not surprising that many domestic workers regard it as most objectionable. Bearing in mind that in the average house the work is carried out at least three times daily, every one in charge of a home should insist on its being done under the most hygienic conditions possible.

The provision of a glazed sink, draining boards, a lavish supply of hot water, and a shelf or two within arms' reach of any one standing at the sink does much to remove the drudgery from the work.

As with all other household tasks, method is essential. All soiled glass, china, and silver should be collected on a table or draining board to the right of the sink, and sorted. In a small household (provided the kitchen is on the same level as the dining-room) a considerable saving of labour can be effected by packing the dirty things on to a tray wagon in the dining-room. The wagon can then be wheeled to the right-hand side of the sink in readiness for washing up.

In order to keep the water in a clean condition the plates and knives should be scraped free from grease and particles of food before they are packed up. A small plate scraper, resembling a rubber squeegee, is excellent for the purpose, although a flexible knife is almost as satisfactory.

However carefully prepared, washing up will not prove a pleasant task unless the water is softened and sufficient soap added to produce a lather. It is important to remember that the unpleasantness of the work is due to the presence of grease which invariably collects on the sides of the basin and on the dish-cloth. This can only be eliminated, by adding sufficient soap to produce a lather. Softened soapy water is capable of emulsifying grease and oil, and therefore those who wish to wash up in a clean manner should always use very hot, soapy water. The cheapest way of softening water is by adding a small quantity of carbonate of soda or washing soda. Unfortunately the majority of workers add far more soda than is necessary, with the result that their hands crack and become harsh. Borax and ammonia are also capable of removing the hardness of water. If preferred, soap powder—a mixture of washing soda and powdered soap—can be used.

At least three large drying up cloths—a separate one for glass, china and silver, and a mop should be provided, and those with delicate skins find rubber gloves a great boon.

In passing it may be observed that if French chalk be sprinkled inside rubber gloves and over the hands before they are put on, no difficulty will be experienced in removing them without damage—which frequently occurs when taking off rubber gloves after the hands have been in hot water for some time.

The dirty things should be dealt with in order of cleanliness as follows :—

Glass.
Silver.
China.
Earthenware.
(e) Knives.
(f) Tins, cooking utensils and saucepans.

The work is more speedily and more satisfactorily executed when two workers take part. Should there be only one, however, only a few things should be washed and drained at a time. When much washing up has to be done it is advisable to use two basins, the second containing clean hot water for rinsing.

The cleaning of saucepans and meat tins frequently requires more drastic treatment than just washing in soapy water. The hotter the water, the more quickly the grease is removed, but often some abrasive cleaner—such as steel wool and scouring powders of which there are many on the market—is necessary to remove burnt-on particles. Care is required when using the majority of pot scourers to prevent pieces of metal coming in contact with the food.

The most labour-saving method of cleaning a burnt saucepan is to fill it completely with water containing plenty of washing soda, bring this to the boil, and allow it to simmer for several hours. This treatment is generally sufficient to clean even a badly burnt pan, but occasionally a little scouring with silver sand and soap may be necessary.

Before leaving the subject of saucepans, it must be emphasised that soda should not be used for washing or cleaning aluminium, as it has a roughening action on the surface.

A clean worker would not consider that the washing up was complete until the dish-cloth, basin and sink had been cleaned thoroughly and freed from all trace of washing up water. After throwing the soiled water down the drain the cloth should be wrung out tightly, placed in the basin, soap powder added, and a little boiling water poured over. The cloth should then be rubbed until it is quite clean. This "scald" obviates the unpleasant "sour" smell frequently associated with a dish-cloth.

Care of Sinks.

The soapy water should then be used to wash the outside as well as the inside of the

A COMBINED KITCHEN-SCULLERY
With gas stove, coke water-heater, and a clip-on draining board to save space at the sink.

bowl and the sink. If the washing up be carried out in the way described the waste pipe from the sink does not become greasy or foul, but if cold, greasy water is constantly poured down, the pipe becomes coated with fat, with the result that not only does it readily become blocked, but it is very liable to smell unpleasantly, particularly in hot weather.

As a precautionary measure it is a good plan to flush the sink and waste pipe with boiling, or very hot, water containing a little soda, at least once a day, preferably after washing up the dinner things. The gulley over which the sink pipe discharges must also be kept sweet and clean, and should be brushed out briskly with hot, soapy water immediately after cleaning or flushing the pipe.

The regular use of a good disinfectant, such as Izal or Lysol, is recommended for health reasons. It should not be regarded only as a deodorant to mask an unpleasant smell, caused by neglect, for if kept clean kitchen sinks and drains remain perfectly sweet.

HYGIENIC SURFACES

By D. D. COTTINGTON TAYLOR, Director of the "Good Housekeeping" Institute.

THE dreary kitchen with walls hung with old and faded paper to imitate grained wood, with dark brown paintwork, and table top and shelves of well-worn and discoloured wood, is fast disappearing, for the modern housewife appreciates the value of surfaces which do not permit dirt or germs to penetrate. Disregarding the saving of labour made possible by the introduction of porcelain enamel, plate glass, glazed tiles, and enamelled walls, the fact that they are absolutely non-absorbent reduces to a minimum any risk of danger that is of necessity associated with dirt and germs. When building, in addition to the selection of non-absorbent material for practically all kitchen, scullery and bathroom surfaces, special attention should be paid to the elimination of all unnecessary beadings, mouldings and joints, which appear to be designed with the one object of accumulating dirt.

The question of floor coverings is discussed in another place, and it is therefore sufficient here to emphasise the importance of seeing that whenever possible they are "jointless." A board floor covered with linoleum could not make this claim, but if the floor covering is cut and fitted carefully, and a "coving" provided at the junction of floor and wall, it becomes almost "jointless" and may be considered to be sanitary. Jointless composition, terrazzo and smooth tiles make ideal floors for kitchens, corridors, pantries and larders.

Wall Treatments. If the walls are in a good condition, the application of two or more coats of paint and one of enamel is an ideal treatment. The paint fills up pores and the enamel produces a smooth surface which can be washed frequently with soap and water, without detriment.

In passing, it should be noted that it is not advisable to postpone washing the painted walls of a "much used" kitchen to the annual spring clean, for if neglected they become very grimed and hard work is required to remove the dirt.

Where strict economy is essential, the lower portion of the walls to a height of 3-4 feet should be painted, and the upper portion, which becomes soiled less readily, treated with washable distemper or wall paint. Old and shabby walls can be rendered more sanitary by fixing imitation tiling, which consists of metal sheets enamelled to imitate tiles. As the cheap varieties of this wall covering are sometimes made of tinned iron, they are liable to rust after having been in use some time, it is therefore advisable to purchase only that which is guaranteed to be made from zinc. The fixing of imitation metal tiling occupies little time, and the work can be done by any handy man.

GLAZED TILES, which may be white, cream, or any other light colour, should be fixed around the sink and range, and if expense does not need to be studied carefully, they may with advantage be fixed to dado height on all the walls.

HYGIENIC SURFACES
This well-planned kitchen is provided with porcelain enamel table and shelves, and porcelain draining boards.

First quality glazed tiles are, of course, expensive, but "seconds" are obtainable, and whilst they are not perfect, from a hygienic point of view they are entirely satisfactory.

Washable Wall-papers must be counted among hygienic wall treatments, for dirt, dust and grease can be removed by scrubbing with hot, soapy water without detriment. In manufacture, the paper, which is specially strong, is given a coat of oil paint which renders it impervious to water, and this enables it to be cleaned when necessary. For this reason it is specially suitable for the walls of day and night nurseries, passages, kitchens and bedrooms.

Shelves and Tables.

It does not require much thought to realise that frequent scrubbing opens the grain of wood, and roughens the surface. For this reason it is not satisfactory for kitchen table tops, unless covered with some non-absorbent material.

Porcelain Enamelled Iron has proved to be ideal for tables and shelves. Those who already possess good strong tables may be glad to know that it is possible to buy sheets of enamelled iron to fit any surface of reasonable size at a cost of 2*s.* 6*d.* per square foot.

In the course of a year a considerable saving of time, labour and soap is possible in houses where white wood surfaces are covered with either glass, or porcelain enamelled iron, for such non-absorbent materials only require a wipe with a damp cloth to keep them spotlessly clean. In such a kitchen, a pastry board is unnecessary for the mixing and rolling out of pastry can be done directly onto the enamel.

Before dismissing the subject of enamelled iron, attention should be drawn to the fact that the highly glossy finish is liable to be dulled slightly by the action of acid and alkaline substances. This slight dulling in no way detracts from its hygienic qualities, but those who are anxious to retain the brilliant

surface, must remember to wipe the enamel when such things as milk, vinegar, lemon, orange and other fruit juice, or washing up water containing soda, are spilt.

PLATE GLASS has all the advantages of enamelled iron and is ideal in every respect, with the one exception that it requires careful handling, otherwise it cracks, and therefore whilst it can be recommended whole-heartedly for such purposes as bathroom shelves, pastry boards, rolling pins, and for the covering of the tops of writing-desks, dressing-tables, sideboards, etc., it proves somewhat expensive for the tops of kitchen tables which are very likely to be used to accommodate hot meat tins, saucepans, etc.

No difficulty should be experienced in purchasing plate glass from any hardware and builder's merchants, and the price depends on the quality and weight.

THE WALL TREATMENT—I
Washable paint or enamel is ideal for the kitchen and scullery, with glazed tiles fitted around the sink.

Newer even than plate glass, and of very attractive appearance, is material which resembles both marble and opal glass. The polished surface makes it ideal for such purposes as wall linings in larder and kitchen shelving, refrigerators and for table tops.

MARBLE AND SLATE, although not new, make excellent shelves for the larder and meat-safe, for they are both non-absorbent and "cold," and are not unduly expensive.

FLOOR COVERINGS

By D. D. COTTINGTON TAYLOR, Director of the "Good Housekeeping" Institute.

IN the average home the floors of most of the living-rooms and bedrooms are of wood, laid either in boards or blocks. Where expense is not of paramount importance, hard wood, frequently oak, is used, and whether in the form of parquet, boards or blocks, the effect is very delightful, for with the aid of suitable wood dyes an almost unlimited variety of different coloured floors can be obtained. Hard wood floors withstand heavy traffic and may be covered or not as preferred with loose rugs or carpets, rectangular or oval in shape.

Wood Floors.

"The first cost is the last cost" can truly be said of a well-laid oak or teak floor. From a hygienic point of view it can be whole-heartedly commended for, although it is not jointless, the joins are so carefully made that dust cannot possibly collect. An occasional sparing application of wax is sufficient to nourish the wood and protect it from wear. Although soft woods, such as Canadian spruce, hemlock, pine, etc. have not the same hard wearing qualities as oak or teak, they make very satisfactory floors provided that they are carefully prepared, accurately laid, and treated with a non-varnish stain. There is no reason why blocks or boards of soft wood should not be laid sufficiently carefully to produce a hygienic surface. Old wood floors, however, frequently collect dust and are draughty and for these reasons it is frequently advisable to cover them

entirely — the surrounds with linoleum or felt, and the middle with carpet.

THE WALL TREATMENT—II
Painted walls are both hygienic and attractive for living room use.

Stone and Brick Floors.

In old country houses the ground floors are commonly of brick or stone flags, and as the majority of these houses were built without a damp proof course, or other means of preventing ground moisture from penetrating the floor, they are frequently damp. Therefore care should be taken not to cover them with any material which hinders free circulation of air.

Linoleum and rubber carpeting are therefore quite unsuitable coverings for a stone or brick floor which has the slightest tendency to dampness. Moreover, such coverings would wear badly if laid on top of an uneven stone or brick floor; therefore hard wearing but porous materials such as rush, cocoanut fibre, or Textilose matting should be selected.

Linoleum.

Linoleum, one of the most modern of floor coverings, is now obtainable in a wide variety of artistic designs and attractive shades, and this undoubtedly explains its popularity with the housewife of to-day. Dainty jaspe linoleums in soft colours, eminently suitable for nursery or bedrooms, are obtainable at a very reasonable price, whilst for halls, kitchens and surrounds of living-rooms, manufacturers provide floor cloths to imitate bricks, tiles, marbles, parquet and board.

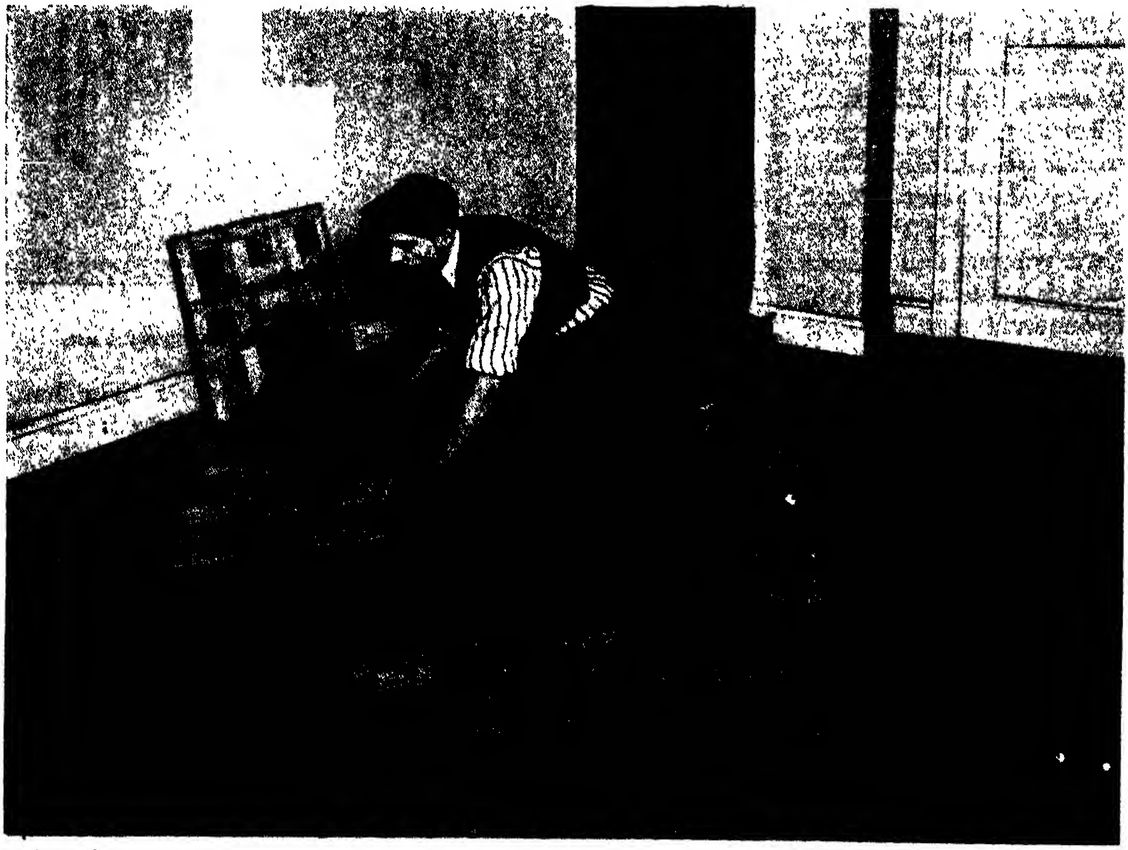
Linoleum is made from powdered cork and linseed oil. The oil is mixed with the cork, various gums, and the necessary colouring matter added. This plastic mass is then pressed on to a backing of strong canvas by steam-heated rollers. For hard wear, plain linoleum having the same colour throughout, or inlaid linoleum in which the colours of the pattern go right through to the canvas, should be selected in preference to a printed linoleum which is ordinary plain linoleum on which a design is stamped. Although the latter cannot be recommended as very durable when subjected to much traffic, as the pattern wears off long before the floor cloth is worn out, it is quite suitable and less expensive for rooms that are seldom used or for bedroom surrounds.

All plain and inlaid linoleums require frequent feeding, either with a good furniture oil and polish, or with wax in paste or liquid form. Linoleum has the advantage that it is

dust and draught proof, warm and resilient, does not absorb grease or water, and is easy to clean. It must therefore be considered a healthy type of floor covering.

To prevent dust collecting between the skirting board and edge of the floor cloth, it is a good plan to add a plain piece of wood beading to the bottom of the skirting. If painted or stained to match either the linoleum or the skirting it will hardly be noticed. New wood floors should not be covered completely with linoleum for it makes an almost air-tight covering, with the result that the unseasoned wood which contains moisture is likely to develop dry rot. It is therefore advisable to leave the floor boards in a new house uncovered for about a year, although treatment with Solignum or creosote affords an additional precaution against dry rot. If the floor in an old house is damp it is also not advisable to use linoleum as the dampness is very likely to cause the canvas backing to rot and the compressed cork to disintegrate. The careless and too frequent use of water for washing linoleum has also the same effect for the water runs between the joins and soaks into the back of the floor cloth, whilst absence of air prevents the evaporation of the moisture. If it is considered necessary to wash linoleum, the water should be used sparingly and the floor wiped as dry as possible.

Rubber Tiles and Carpeting. Although one usually connects rubber flooring with public buildings, it is now used to a considerable extent in private houses and makes an excellent floor covering. It is especially suitable for lavatories, bathrooms and nurseries, for it is impervious to moisture, is draughtproof, warm and resilient. Rubber should not be laid in any room where grease or oil is likely to come in contact with it as



Courtesy] [" Good Housekeeping"

LAYING A WOOD FLOOR

A well-laid wood floor will wear indefinitely, and is perfectly hygienic as dust cannot collect between the joints.

they affect it adversely. Rubber carpeting is cheaper than good quality rubber tiles about a half to three-quarters of an inch thick, but both are now obtainable in very attractive colours and patterns.

The tiles are laid very carefully with special rubber cement which fills up the cracks and renders the floor jointless. When selecting a rubber floor it should be remembered that plain colours, both light and dark, show footmarks more readily than a patterned or mottled flooring.

Jointless asbestos or composition flooring became popular for private houses immediately after the war, when the exceedingly high price of wood made its use for floors almost prohibitive. Composition floors consist essentially of magnesium chloride, with wood flour or fine sawdust. These ingredients are mixed with water and are laid in a semi-solid liquid condition, to an even thickness. As the floor dries it hardens (and it must not be walked upon until it has petrified), it requires rubbing down, oiling and finally polishing. The linseed oil fills the tiny pores and oxidises, forming a smooth surface. The great advantage of composition floors is that they are absolutely jointless, warm, draught proof and impervious to moisture, and are therefore hygienic and suitable for almost any room but are particularly recommended for bathrooms, corridors, kitchens, pantries, larders, nurseries, sculleries and wash houses.

Composition Floors.

CARE AND CLEANING OF FLOORS

By P. L. GARBUTT, A.I.C., First-class Diploma in Household and Social Science, King's College for Women.

THE most common floors and floor coverings are stained boards, parquet and wood block floors, composition floors, cork carpet, rubber, cement and tiles, and those covered with carpets or rugs. The care and cleaning demanded by these naturally varies considerably and it will prove profitable to discuss each separately.

Provided these have been stained with a non-varnish stain all the care required is daily dusting and weekly polishing with wax polish. Varnish stains never prove very satisfactory, as they invariably wear in places where there is much traffic. The daily dusting of stained as well as other types of flooring is most easily accomplished by utilising a long-handled mop which should be washed not less than once a week. For the weekly polishing, either a weighted hand polisher or, ideally, an electric one are recommended as these do away with all necessity for kneeling. The cost of the former averages 15*s.* to £1, while a small electric polisher suitable for ordinary household use can be purchased for less than £10, and in view of the fact that the current consumption is exceedingly small, the purchase of one is worth while in any house where there are comparatively large polished floor areas. The wax itself is most conveniently applied by means of the small wax appliers now obtainable for a few shillings, and, except in the case of a new floor which at first absorbs a good deal of wax, only a sparing amount is required. When the ordinary paste waxes are used it is quite a good plan to dilute them with turpentine, for when this is done there is less likelihood of too much being applied and the floor becoming greasy and smeary in appearance.

Stained Boarded Floors.

Sometimes parquet and wood block floors are stained a dark colour and the treatment then required is the same as that described above. In most cases, however, such floors have only been slightly darkened by the application of linseed oil. When this is the case the floor, being a fairly pale colour, shows dirt and soils more readily, and in addition to daily dusting and weekly polishing, as advised above, it is usually found advisable to rub over the floor occasionally, working the way of the grain with a medium grade of steel wool, which removes all soiled wax. It is perhaps hardly necessary to point out that especially in the case of a pale coloured floor it is of the utmost importance to see that all cloths and

Parquet and Wood Block.

HOW TO MAKE A GOOD POLISH FOR WOOD
Dissolve 2½ teaspoonfuls of shredded beeswax in ½ pt. of turpentine by standing them in boiling water. Add slowly ¼ teaspoonful of potassium carbonate, ½ teaspoonful of soft soap and ½ pt. of warm water, mixed together.

brushes used for dusting and polishing are kept scrupulously clean.

Linoleum. When selecting a linoleum it is important to choose one in which the pattern is inlaid, as those with a printed surface naturally cannot be expected to give lasting wear. If an inlaid linoleum is to wear well, however, it requires regular polishing with wax polish, and it is most important to avoid washing it more than is absolutely necessary, for frequent wetting causes it to deteriorate and finally rot. This is specially the case if water is allowed to penetrate underneath, as it is likely to do at the junction of the skirting board and floor. When polish is applied regularly, but sparingly, a more or less impervious surface, through which dirt does not readily penetrate, is soon formed and the linoleum is kept clean with very little effort, provided all spilt liquids, etc., are dried up as soon as possible. In the case of pale coloured linoleum, a white wax polish is usually preferable, as it has not the same darkening properties as the more darkly coloured polishes.

A cork floor covering is of a particularly porous nature and therefore readily stains and becomes soiled. It is indeed one of the most difficult of all to keep clean and except for its warmth and softness has little or nothing to commend it.

Cork Carpets. Those who already possess this floor covering may be glad to know that by rubbing in linseed oil and polishing with wax polish it is possible to render it more impervious and thus more like linoleum. After the carpet has been scrubbed as clean as possible linseed oil should be well rubbed in, and after allowing ten days or a fortnight for the oil to oxidise, a further application may be made. Ten days or a fortnight later wax polish can be applied. A good deal is usually absorbed at first and it is a good plan to apply it by means of a dry, soft, scrubbing brush or a nail-brush. Before the above treatment some may care to stain the carpet if it is a pale coloured one, and in this case an oil stain, such as Brunswick Black diluted with turpentine, has been found to give the most generally satisfactory results for this purpose.

Rubber. A rubber floor has the advantage of being soft and quiet to the tread. Provided a marbled or other patterned one has been selected it does not readily show footmarks and requires little care. It should be cleaned with warm soap and water, and if badly stained a slightly abrasive cleanser may be used, or when specially drastic treatment is required it may be rubbed with a cloth dipped in petrol. The latter, however, should only be used sparingly as it actually dissolves rubber and thus tends to wear away the surface. Although rubber flooring proves satisfactory for the bathroom, stairs, etc., it cannot be recommended for use in a kitchen or other place where it is likely to come in contact with grease.

COMPOSITION FLOORS usually consist essentially of magnesium chloride cement together

with filling material, and require to be regularly polished as in the case of the other floorings discussed.

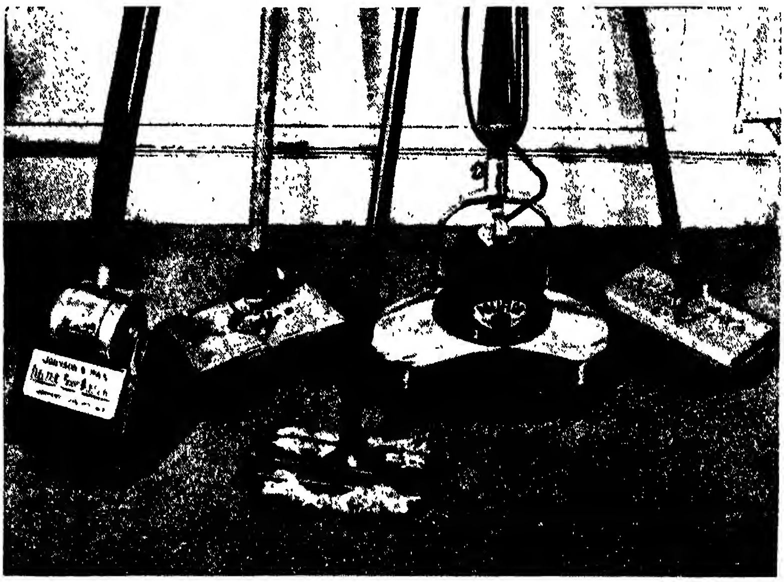
The red quarry TILES usually laid can either be washed and scrubbed or preferably polished weekly with wax polish. When waxed the tiles soon acquire an impervious surface which dirt does not easily penetrate and thus washing is only required very occasionally.

CEMENT FLOORS often prove a difficult problem as not only are they hard and cold but the appearance is not particularly good. If perfectly level, linoleum can be laid over such a flooring, being attached to the cement by means of a special linoleum cement. Another means of dealing with a floor of this description is to treat with a floor paint and lay down rugs. In the kitchen washable rugs such as cocoanut fibre or those made of wood pulp are suitable.

Carpets and Rugs.

The old-fashioned way of cleaning carpets and rugs was to brush regularly and to take up and beat once a year or possibly twice a year. The brushing process was a dusty one and a good deal of the dirt was merely brushed into the atmosphere, to settle on other articles of furniture, etc. In the modern house the cleaning is more hygienic and aims at removing the dirt as dustlessly as possible. This revolution in household cleaning methods has been made possible by the introduction of vacuum cleaners. These remove dust and soil from carpets, upholstery, etc., sometimes wholly by a process of suction and in other cases partly by suction and partly by other means. There are now very many types of cleaners on the market; these include both hand and electric cleaners. Provided current is available there can be no doubt that the latter are preferable, for not only are they as a rule more efficient, but they are also considerably more labour saving. The current consumption of such cleaners is exceedingly low, averaging not more than a quarter or a fifth of a unit per hour, so that even if run from a lighting point they cannot be considered costly.

Two main types of electric cleaners are on the market—those provided with a handle like a broom and those with an enclosed bag. In the former type the whole cleaner is pushed over the floor and having a comparatively large nozzle cleans even a large floor quickly. These cleaners are indeed specially suitable for households where there are large carpeted areas. There are various machines of this type, the prices ranging from eight or nine pounds to twenty. Although some of the cheaper ones are very efficient, and good value for the price charged, it is obviously impossible to expect their efficiency to be as great as those of the more highly-priced machines. As well as relying on suction for cleaning, most of these cleaners are also provided with some other means of aiding in the removal of surface litter such as cotton, fluff, etc. In many cases brushes are used for this purpose. These may be



SOME MODERN FLOOR POLISHERS
For polishing and applying wax to linoleum and wood floors.

Courtesy] [Good Housekeeping

TWO TYPES OF ELECTRIC CLEANER

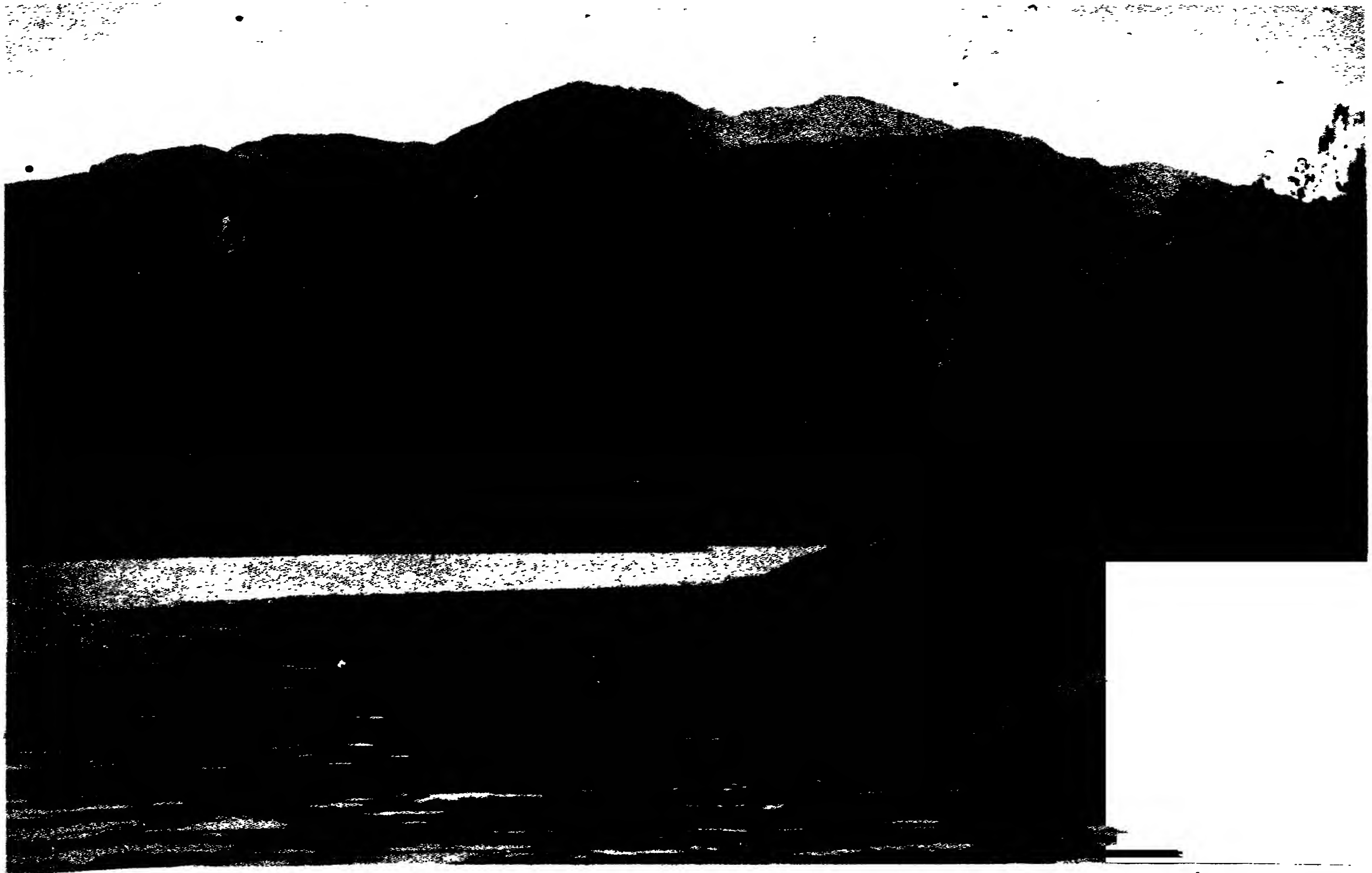
These can be used for curtains and upholstery as well as for carpets and rugs.

stationary or they may revolve with the wheels of the cleaner or yet again they may be motor driven. Especially in the latter case the removal of dust, etc., is so aided that the suction can be considerably less than in the case of a cleaner relying on suction alone and yet give as satisfactory results. Other devices, such as rubber beaters or metal teeth, are sometimes provided instead of the more usual brush.

The other type of electric cleaner, viz., the one with an enclosed bag, is usually found more convenient in the small household, as it is possible to clean underneath and around furniture without moving it. This variety of cleaner relies on suction only, and if this is comparatively high it proves very efficient for removing embedded dirt, but not being provided with a brush it does not as a rule prove so satisfactory for removing clinging hairs, fluff, etc. Being small and easily portable, enclosed bag cleaners are also particularly convenient for cleaning stairs, walls, upholstery, etc.

In country districts or in other places where electricity is not available the use of a hand-power cleaner is recommended. There are three main types, viz., broom handle cleaners, those worked on the principle of a pair of bellows, and those whose action can be compared to that of a pump. The efficiency of hand-power broom handle cleaners depends upon obtaining a good swinging movement, for under these circumstances the fan causing the suction revolves rapidly. They can only be used for cleaning floor coverings and other articles which can be laid flat on the floor. The bellows type of cleaner is thus more useful for general household cleaning. Small cleaners of the bicycle pump type are cheap, costing only a pound or two, but they are somewhat tiring to use.

From a consideration of the above it will be seen that it is quite impossible to say that any one vacuum cleaner is the best on the market, for each one has its individual points making it specially suitable in certain cases. A vacuum cleaner should be used once or twice weekly for all rugs, carpets, upholstery, etc., and a carpet sweeper can be used daily to remove all surface dust and pieces.



[L.M.S. Rly. 6 Courtesy]

A FINE NATURAL RESERVOIR

A view of Loch Katrine, the chief source of Glasgow's water supply.

XXIV

PUBLIC HEALTH

THE TEST OF AN A.1. NATION

By SIR W. ARBUTHNOT LANE, Bart., C.B., M.S., F.R.C.S.

IT is not very long ago that all civilised nations accepted the figures of their birth-rates as, at least, a crude test of their virility, and an index to their standing in the world. Even now, the anxiety shown by many persons on the publication of the quarterly figures of the birth-rate showing a steady decline is an indication that the idea of "quantity" of population dies hard. We are only very slowly learning that what really matters is the quality and the standard of health of the average individual. Even the death-rate is a better test of a nation's well-being than the birth-rate, especially when it shows the number of infants born that are saved, compared with the awful mortality that prevailed a few decades ago. By these tests the Dominions of New Zealand, Australia, South Africa and Canada, in the order named, stand easily highest in the world. Though their birth-rates have fallen, that of England has fallen much further, while their general death-rate and infant death-rate are very much lower than that of England.

These facts point us clearly to what is going to be the true test of the A1 nation of the future. People who think only of quantity should look towards Russia, whose recent figures show that her birth-rate is more than twice that of England. But her general death-rate is also nearly twice that of England and her infant mortality over three times—a truly appalling state of things.

What guidance does all this offer us for the future? Nothing could be clearer. The

[Topical

THE TEST OF AN A1 NATION

The future mothers of the race—German girl gymnasts seeking health through fresh air and exercise.

people of the British Dominions live nearer to nature, both in their work and their food. Their high standards of social welfare are known to the world. In addition to what alert intelligence and natural fortune have brought them, they have the boldness to accept, without question, the latest teaching in matters of health.

In a recent report, the Director General of Health for New Zealand proudly claims that "There is probably no country in the world to-day where the fundamentals of healthy growth—fresh air, sunlight, food of the right type and amount, adequate sleep and rest, wholesome exercise, are more readily available than in New Zealand." But he is careful to add that these benefits should be more fully utilised. School medical officers report that "tea, white bread and meat play the chief part of the dietary in many homes. In New Zealand, eggs, milk, cheese, butter and fresh fruit and vegetables should be available in such abundance and at low enough prices to take the place of the excessive use of meat in many households."

Our kinsmen overseas realise that it is not enough to save the babies, but that health

Health Education.

education must proceed right through the school period until the right habits are ingrained in the minds of the people. Through their health camps and nutrition classes the New Zealand authorities have literally transformed the physical and mental condition of many thousands of their people. We have abundant proof that the same splendid results can be achieved in Great Britain. The magnificent physique and handsome appearance of Wellington's soldiers can be repeated in our rising generation by following a similar dietary of natural unspoilt foods. As a race, we should be enjoying the great physical inheritance of our heroic ancestors. But a few generations have seen the universal adoption of manufactured and de-natured foods poison the whole of the nation until ill-health has increased to an alarming degree.

A recent report of Sir George Newman shows that 25,000,000 weeks of work were lost to the nation in one year through temporary illnesses. A loss equivalent to a year's output of half a million workers. Not only do disorders of the digestion constitute a considerable percentage of these cases, but such illnesses as influenza, colds, bronchial troubles, boils and other septic conditions are closely related to the lack of resistance which the body exhibits owing to faulty diet.

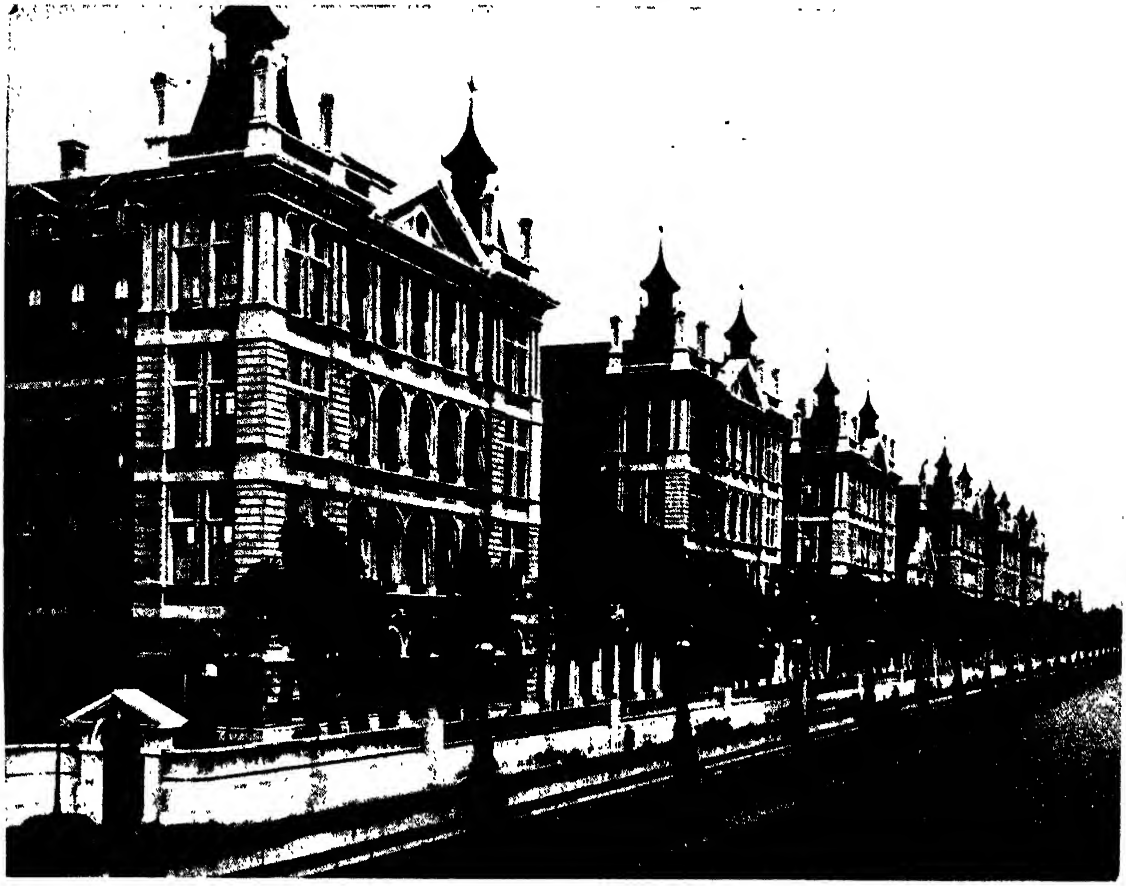
It becomes more essential than ever that the people shall be taught how to build up

Habits of Health.

within their systems the powers of resistance to the onset of colds, bronchial troubles and ill-health generally. The micro-organisms which convey various infections, carried by insects or present in dust and dirt, cannot wholly be avoided by anybody. But it is quite a mistake to suppose that when they are encountered they must inevitably cause illness. For everything depends upon the fighting capacity of the body, and that almost entirely depends upon the habits of the individual—the way he dresses, the amount of fresh air with which he surrounds himself, the exercise he takes and last and most important of all, the diet upon which he builds up the forces of that wonderful mechanism, his body. And if he tries to build it upon the shoddy stuff of white bread and manufactured foods from which all the vital substances have been extracted, he will become a victim to the worst evil of civilised life, the poisoning of the body by failure to remove from it regularly and frequently the waste products of digestion. We ourselves, and not the germs waiting to attack us, prepare the ground for the frequent temporary illnesses that afflict the vast majority. When the end comes, it is the final stage of a long trail of bodily disorders which should never have happened. The remedy lies in the great trilogy of healthy living—right food, fresh air and sunlight, and regular removal of the waste products of the body. Wholemeal bread, fresh fruits and vegetables, milk and other dairy products, these are the ideal fuel for the human engine.

Many years ago Herbert Spencer penned a reproach that is unhappily still true to-day:

"To tens of thousands that are killed, add



[D. McLeish

ST. THOMAS'S HOSPITAL
One of London's largest hospitals, with 632 beds and costing about £185,000 a year to run.

hundreds of thousands that survive with feeble constitutions, and millions that grow up with constitutions not so strong as they should be; and you will have some idea of the curse inflicted on their offspring by parents ignorant of the laws of life."

The education of the people, so as to promote freedom from disease and the greatest degree of happiness and prosperity, lies above all in the simple health teaching which I have outlined.

THE NATIONAL HEALTH

By J. S. BAINBRIDGE, M.Sc., Author of "The Human Machine" etc.

ILL-HEALTH—preventable ill-health—is the most costly habit man has to-day. Each year it robs him of a large percentage of the fruits of his labour; firstly, because he is frequently compelled to absent himself from work, and secondly, because while he is at work his health is often but a shadow of what it could and ought to be, so that his output is thus vastly diminished. Preventable ill-health is followed in many cases by what could be a preventable death; and of those who survive to reach man's allotted three-score years and ten it can be said of too many, alas, that although they were buried at seventy, they really died at forty.

Public interest, although it is increasing, has not yet been effectively aroused as regards the enormously widespread and costly results of preventable disease. The Annual Report of the Chief Medical Officer of Health contains statistics which ought not only to horrify but to warn, and a study of these should lead to widespread changes in the general diet and habits of living of the vast majority of the population.

Properly to develop the argument, and to prove how vitally necessary it is that the plan of campaign should succeed, it will be necessary to discuss three points. Firstly, what is the annual cost of disease; secondly, how much of that disease could be prevented; and thirdly, is there any evidence to prove that the argument outlined under the second heading is true. That is, has any effort ever been made, over an interval of time sufficiently great to enable sound generalisations to be drawn, to prove that it pays to spend money on a health campaign?

Annual Cost

To some extent any estimate of the annual cost of disease must be tentative. For example, it is impossible to say what would be the real productiveness of a nation of really healthy workers. It can safely be said that the national income, which now amounts to approximately £3,000,000,000 per year, is very much below what it might be.

Excluding the loss due to sickness for which no sickness or disablement benefit is payable, Sir George Newman's report shows that in 1925, *among the insured population alone*, the equivalent of 12 months' work of nearly half a million people was lost. This with other known facts gives us figures from which a fairly accurate estimate of the annual cost of ill-health can be computed.

In respect of these insured workers a sum of £2 per week may be taken as the average weekly earnings. There is thus each year a direct loss in wages to this one section of the community alone—the registered workers—of £50,000,000. Every one knows that ill-health is not confined to this one class. The unregistered workers, who include all the professional classes—scientists, lawyers, engineers and so on—are affected to an equally large extent.

To place the direct loss per year in wages alone of all workers at £100,000,000 is certainly not to over-estimate that part of the nation's ill-health bill which comes under this heading.

Sick and injured men cannot look after themselves, and the second very serious item in the ill-health account, to quote Sir George Newman's report, is "the labour and expenses entailed in their care during their incapacitation." This item will certainly be as large as the amount lost in wages (£100,000,000). In addition to the provision of special foods, etc., this care involves the maintenance of a large number of qualified medical men, of pharmacists and chemists who can prepare the medicines prescribed by these medical men, and of thousands of nurses and attendants to staff the many hospitals, infirmaries, nursing homes and asylums to which the more serious cases have to be taken. These hospitals and other institutions have to be built and equipped with wards, operating theatres, artificial sunlight and X-ray rooms, etc., and their upkeep involves large fuel and lighting bills and an army of cleaners and attendants.

The number of practising physicians and surgeons in the British Isles (excluding Ireland) is approximately 50,000. It is known that the voluntary hospitals alone spend more than £8,000,000 per year, and, in short, the cost of the various hospitals, medical and other official curative services cannot be placed at less than £100,000,000 per year.

Examination of any of our daily newspapers will reveal the weak foundation upon which our boasted civilisation rests. Page after page is given over to large and costly advertisements recommending the use of a vast number of purgative medicines, tonics, trusses and belts, tooth pastes of marvellous qualities, antiseptic soaps, hair lotions and beauty creams—all the curious and infinitely varying means whereby suffering humanity seeks to improve its health and appearance, and attempts to put off the day when patching up will no longer be possible and visits will have to be made to more responsible advisers.

The amount spent on advertisments of this kind over a period of one month has been estimated, and if it is assumed that 30 per cent. of the total income of all patent medicine manufacturers is invested in advertisements—and it can scarcely be a higher percentage than this—*the amount spent on patent medicines, etc., each year can hardly be short of* £150,000,000,

the most costly and ineffective insurance premium ever paid.

The total annual direct cost of ill-health to this country, therefore, is at least £350,000,000. The population of the British Isles (excluding Ireland) is 44,000,000. It is usual when estimating the number of families to allot 3.5 members per family, on which basis there are 12,500,000 families. The annual cost of preventable ill-health to those families is £240,000,000, *or eight shillings per family every week, month after month, year after year*

Two-thirds Preventable.

The figure on page 1542 has been constructed from the statistics of the Chief Medical Officer of Health, the sizes of the segments being proportional to the number of cases of each disease reported. This chart, it may be noted, concerns insured workers only. That is, it does not include illnesses suffered by any person under 16 years of age. General inferences may be drawn, however, because observation shows that here, as in other departments of life, the child is father to the man. Reports of School Medical Officers, children's hospitals, etc, indicate that rheumatic diseases, colds, and digestive disturbances affect equally large proportions of the juvenile population.

A comparison of this figure with a similar chart constructed from the figures of 100, or even 50 years ago, would bring out some very startling differences. Virulent endemic diseases, such as enteric, typhus and scarlet fever, at that time so widespread, have become of negligible incidence, and cases of, and deaths from, tuberculosis have steadily declined. But tuberculosis, even in 1925, was still responsible for 85 out of every 1000 deaths, as can be seen from the second figure, and probably not less than 1,000,000 people still suffer actively from some form of the scourge. Experience has proved that we could expect tuberculosis, within quite a reasonable time interval, to be as rare in England as bubonic plague, and it is heart-rending that, with all our knowledge, tuberculosis should still be allowed to kill nearly 40,000 people each year, and maim cripple, and render miserable almost a million more.

If the first figure is again examined, it will be seen that, apart from injuries and accidents, more than two-thirds of the recorded cases of illness come under one of the following seven headings :—

[Keystone

THE METROPOLITAN LIFE INSURANCE BUILDING, NEW YORK

The offices of the company which provides free periodic medical examination for its clients—with striking results.

(1) Bronchitis, bronchial and nasal catarrh, colds, etc., which between them account for one out of every five cases; (2) influenza; (3) diseases of the digestive system; (4) lumbago, rheumatism, etc.; (5) abscesses, boils and other septic conditions; (6) debility, neuralgia and headache; and (7) diseases of the nervous system and special senses.

From the second figure it will be seen that the five principal causes of death, which together account for two-thirds of the total deaths, are :—

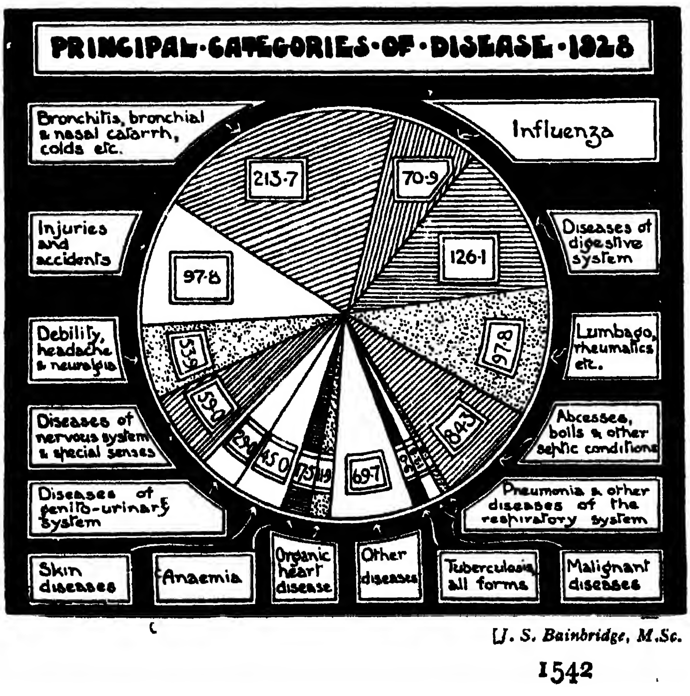
(1) Diseases of the heart and circulation; (2) bronchitis, pneumonia and other respiratory diseases; (3) cancer; (4) diseases of the nervous system, and (5) all forms of tuberculosis.

The segments dealing with the diseases mentioned above, and a few smaller groups such as anaemia, have been shaded in the diagrams, because it is held that they are definitely preventable.

From these figures it would seem that five or six diseases (or groups of closely related diseases) between them account for most of the ill-health experienced. In all these cases, however, the manifestations of disease are a result and not a cause. No man is attacked suddenly by a disease, which hangs about, as it were, until his attention is diverted and then suddenly launches its attack. The attacking process is long-continued and never-ceasing, and it is only when the power possessed by the body of resisting disease has been weakened in some way, that conditions become favourable for the development of the micro-organisms associated with any particular diseases.

The most potent cause of a weakened resistance is a faulty diet. Where the diet has been at fault, sudden changes of the weather, dirt, exposure, smoke and other factors may be contributory causes leading to a still further reduced resistance, and a much more severe illness than would otherwise have been experienced. The surest defence against all disease is, therefore, a diet governed by true scientific principles.

The micro-organisms causing disease are so widely distributed and numerous that it is impossible to avoid the risk of infection, and it is useless to attempt to do so. The only reasonable course of action, and the only course which has any chance of success, is to strengthen and fortify the body until it possesses its maximum protective immunity to these infections, and only sound principles of feeding and healthy living, which can help to build up this protective immunity, should be adopted.

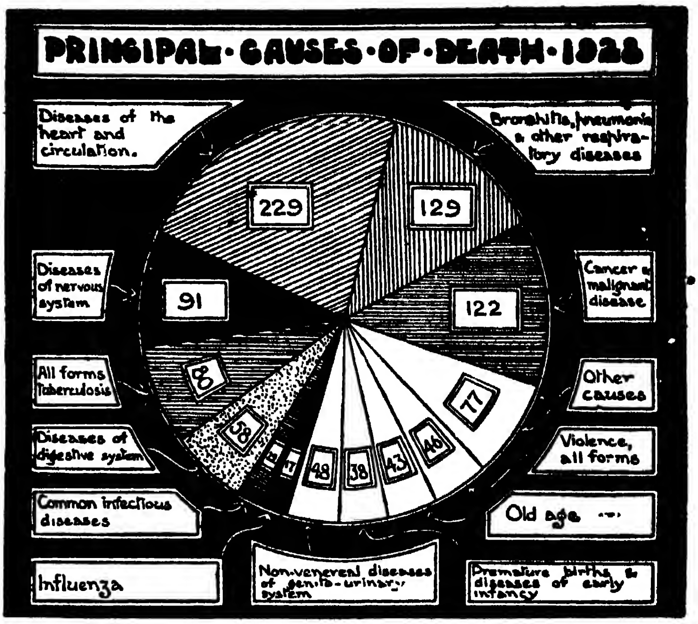


[J. S. Bainbridge, M.Sc.

It is true that the chances of infection can be very enormously decreased by compulsory sanitary and hygienic laws, and it is by measures on these lines that the principal endemic diseases have been almost stamped out. Sound drainage schemes, proper collection and disposal of sewage and other refuse, prompt notification of the occurrence of infectious diseases and isolation of the sufferers, pure food laws—these and other desirable reforms have been instituted by Act of Parliament and compulsorily carried out. Communal safety is secured by means of an active and efficient service of

medical officers of health and sanitary inspectors working under the direct control of the Ministry of Health.

The position as regards individual action, however, although in a sense vastly more important, is also vastly more difficult. A man must become convinced that disease results from a faulty diet, and that his power of resistance to disease can only be maintained and increased by the adoption of a sound nutrition, before he will voluntarily change possibly faulty habits for good ones. Merely to tell a man that he ought to eat wholemeal cereals, fresh fruits and vegetables, milk and other dairy products, in preference to the refined and devitalised white flour and rice and large quantities of meat he at present consumes, will carry no weight at all. He must be made to see that foods differ in quality as do the materials of which his clothes are made.



[J. S. Bainbridge, M.Sc.

He knows that he needs underclothes, but he knows also that he must have a mackintosh or raincoat; and he must come to realise that in just the same way certain foods definitely keep him warm and provide him with energy, but that these will be useless unless he also provides protective foods which supply him with the irreplaceable mineral salts, vitamins and roughage.

Napoleon realised that an army marches on its stomach. Twentieth century civilisation is beginning to realise that it can destroy itself through the stomach, and that it must make a very strenuous effort if constipation, appendicitis, cancer, digestive troubles and septic conditions—all these diseases which are unflatteringly grouped together as diseases of civilisation—are to be checked, lessened and finally abolished.

The three things which constitute the great trilogy of healthy living are pure water, fresh air and sunlight, and pure, natural and complete food; and of the three the greatest is right food.

From a humanitarian standpoint there can be no question that any efforts which may result in a healthier and more efficient human race should be made. It should, however, be unnecessary to plead for help on humanitarian grounds, and upon quite materialistic grounds expenditure on health propaganda can give as good a return—*in cash*—as the finest and most profitable investment.

Health Propaganda.

Many countries—Belgium, Australia, New Zealand, and the U.S.A., for example—officially carry on infant welfare and general hygienic propaganda, but a private insurance company, the Metropolitan Insurance Company of New York, has provided what must long remain the most striking illustration of the economic value of a well-planned health campaign.

The achievement of one company, working definitely for the benefit of one particular section of the community, provides a foretaste of the results which could be achieved by a national effort working on a national scale.*

*See "The Campaign for More Abundant Life," page 381.

PUBLIC HEALTH AND PREVENTIVE MEDICINE

By C. F. J. BARON, M.R.C.S., L.R.C.P., Assistant Medical Officer to Kent County Mental Hospital, Maidstone.

PUBLIC HEALTH implies the consideration of the individual as one of a group of people living a more or less artificial life in a community.

The science endeavours to find out how unnatural conditions affect the health of the individual, and how, if possible, they may be treated and modified so that the resultant affect on his health may be as little unfavourable as possible.

It is necessary to consider such things as the infectious diseases, for example, from a standpoint rather different from that of general medicine. Public Health is concerned more intimately with the questions of the causation and mode of spread of these diseases and with the methods of preventing and combating epidemics.

Other subjects which need to be discussed in this branch of preventive medicine are the natural requirements of the human being—the air he breathes, the water he drinks, and the food he consumes It is clearly important to ascertain how these essentials may be altered in such a way as to cause disease and ill-health, and to gain an accurate knowledge of the morbid conditions which may arise as a result. In passing, also, certain provisions of the law must be noted, which have as their object the empowering of the local sanitary authority to take such steps as may be necessary in the interests of public health.

Public Health work, logically, must begin with prevention, and perhaps more than any other person the general medical practitioner is able to assist in this work from the beginning. He is able to advise his patient in respect of prevention, and since the operation of the National Insurance Acts a vast amount of preventable disease has been revealed by the appointment of panel practitioners. The Public Health authorities, in the shape of the Medical Officer of Health for the district, are more particularly concerned with the infectious or communicable diseases, since these effect the community at large rather than one individual alone.

Preventive measures include the prevention of accidents, and in this connection the

Public Health Law.

enactment of the Workmen's Compensation Act has done a great deal. These laws place the cost of injury directly upon the industry concerned, so that it is to the financial advantage of the employer to prevent as many accidents as possible. As a consequence of these laws many devices have been introduced to prevent accidents, and strict rules adopted to prevent employees from taking risks. In a similar way, efforts are made to reduce to a minimum the so-called "Industrial Diseases," which arise as a direct result of occupation in certain trades.

Such accidents and diseases as those just mentioned are comparatively easy to deal with, as are also those due to gross sanitary defects, which can be remedied. Diseases, however, which are spread by social contact present far greater difficulties from an administrative and public health standpoint. This is largely owing to the resentment with which people regard any attempt to modify or restrict their personal liberty, even though this is clearly essential in the interests of the health of themselves, their families, and the community as a whole. Such contagious diseases are largely spread because of the difficulty of making the public observe rules of quarantine and isolation.

The lines of attack in preserving and augmenting the health of the community, then, become clearly indicated along certain paths—the prevention and control of infectious diseases, the prevention of diseases known to be conveyed by impure air, impure food, and impure water, the endowment of local sanitary authorities with still greater power to effect this supervision, the provision of ante-natal and maternity clinics, and the establishment of centres for child-welfare. In this way early defects can be

Courtesy] [*Leyland Motors Ltd*

A DEVICE FOR PREVENTING ACCIDENTS

The gangway in the machine shop of a motor works. It is defined by broad white lines and must be kept clear of obstruction

treated from the beginning. The treatment of venereal disease, too, must be regarded as essentially a question for the health authorities, and, in an exactly similar way, every case of tuberculosis must be regarded as a potential source of infection and should be treated as such.

WATER

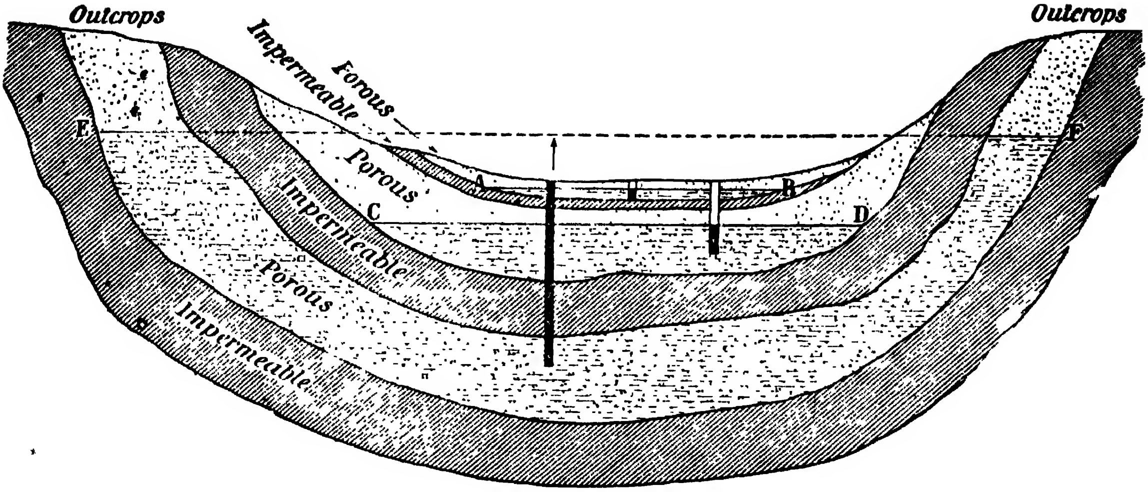
One of the chief objectives of the Public Health Service is to secure an adequate supply of pure water. On this, obviously, must depend the general health and cleanliness of the inhabitants, their freedom from water-borne diseases, and more indirectly, that increased resistance to infection which will prevent their falling victims to other diseases not actually conveyed by water.

In order to follow the means by which this pure water supply is ensured, it is necessary to study firstly the sources of water supply, and later to consider the various methods of collecting and storing, and, finally, of distributing to the places where it is required.

Rain is a natural source of water, and at the commencement of its fall is in an almost pure state. As it falls, however, it becomes polluted with dust, soot, certain gases, and bacteria, and finally, reaching the earth, it dissolves constituents of the soil on which it falls. Thus the soluble constituents of the soil give the water the special characteristics of the locality concerned.

On meeting the soil some rain will evaporate, some will flow down the incline of the surface, and the rest will sink into the soil. In this country the surface collection of rain water is not relied on to any great extent for drinking purposes, and it is necessary, therefore, to consider the fate of the rain water which penetrates below the surface of the soil.

Passing down through the soil, it meets, sooner or later, an impermeable layer, such as clay, and the rain water collects above this layer. It fills up the minute spaces of the soil, and is known as "ground water."



Courtesy] [" Hygiene and Public Health," Parkes & Kenwood. (London: Lewis & Co.)

HOW WELL WATER IS OBTAINED

A diagram of the earth's strata, showing shallow, deep and artesian wells. A-B : subterranean water level in surface strata, C-D : in deep strata, and E-F : in water-bearing strata supplying the artesian well.

Sometimes the impermeable layer only partially acts as a barrier to the downward passage of water, and, under these circumstances, some of the water penetrates lower still until it meets a second impermeable layer, and forms a second and lower available source of water. A reference to the figure on this page will show that both these accumulations of water can be tapped by wells ; the former by a surface or shallow well, and the latter by a deep well.

Wells.

Surface wells are simply made by sinking a pit of sufficient depth. They are, however, very liable to pollution by human excreta, and, in order to minimise the risk of this occurring, they should be lined with brick and cement ; the top should be above the ground level, and a sand filter should be placed at the bottom of the well. Finally, the well should be reasonably far removed from any potential source of pollution.

Deep wells are, of course, sunk through an impermeable layer and are much safer, inasmuch as they are far less prone to surface contamination. Nevertheless, the construction of these wells requires equal care. The water contained in them is pure and safe.

Artesian Wells are found where water is confined at a high pressure between two impermeable layers. When it is tapped the water rises high above the ground level and is usually very pure.

Sometimes the water is forced up naturally by some obstruction and a *spring* is then constituted, but care is necessary that this form of supply is not being contaminated by sewage from neighbouring dwellings. In the case of both springs and wells generally it may be said that the deep variety is more likely to yield a safe water.

The water of rivers, streams and lakes is in general not a safe supply—it is subject to contamination or pollution by sewage and drainage. In certain cases, however, large areas of land are set apart for the collection of water, these areas being known as " catchment areas." All the water flowing from an area such as this is led into an artificial reservoir, the size of which depends on the number of people to be supplied. During its stay in the reservoir the water is purified by sedimentation, and sometimes by the addition of a dilute solution of copper sulphate, which stops the growth of certain minute organisms.

It is usually necessary to purify water gathered from lakes, rivers and even from

the selected "catchment areas," which frequently contain organic impurities in their water.

Water Purification.

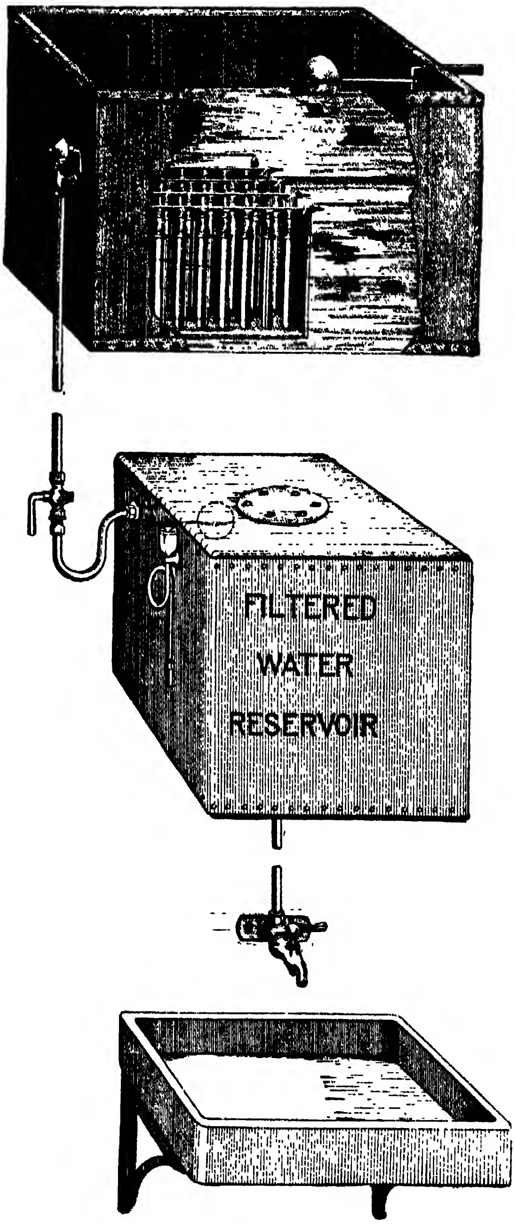
The most popular method of purification used in this country is the sand filter. This filtration is done in large areas of about an acre containing successive graduated layers of material, fine sand at the top, and coarse stones at the bottom. At first the downward filtration is rapid, but later the bacteria separate out and form a scum which acts as a further filtering layer, and renders the process a slow one. Sand filtration is very successful, especially in removing bacteria of the enteric or typhoid group. In addition to this method, there are various mechanical and chemical methods of purifying water, such as by the addition of alum or lime.

In most cases the water supplied by the local authority requires no further treatment, but in other instances the need arises for the domestic purification of water. For this purpose the most certain method is boiling of the water, but this becomes irksome when large quantities are required. Probably the more convenient method is by some form of porcelain or clay filter attached to the taps; of these the best known is the Pasteur-Chamberland Filter. This requires frequent cleansing and boiling in order to prevent clogging.

The actual supply to houses may take place by "gravitation" if derived from high-lying ground, or, alternatively, it may require to be pumped in order to reach its ultimate destination.

It is important that the water should not be subject to any contamination (*e.g.*, by the neighbouring gas and sewer mains), after filtration, and it is therefore brought to the town in large cast-iron pipes, the joints of which are absolutely water-tight. From this water main a service pipe leads to each house. As a rule the supply from the main is continuous, but in certain districts, where the local authority provides an intermittent supply only, the use of a cistern as a reservoir becomes necessary. This should be covered, and should be cleaned out every three months or so. In cleaning, the deposit on the inner surface of the cistern should not be disturbed, since this protects the lead against the solvent action of the water.

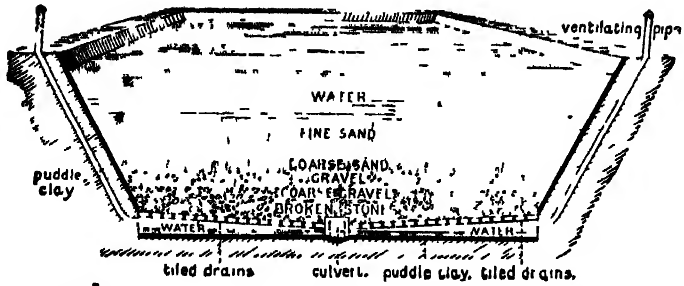
Certain diseases are definitely traceable to a polluted water supply, and, of these,



Courtesy] [*British Pasteur Chamberland Filter Co.*

A HOUSEHOLD WATER FILTER

Rows of Pasteur-Chamberland filter-tubes in a cistern which supplies filtered water to a reservoir through a syphon tube. A simpler type can be attached to the taps themselves.



Courtesy] [Elements of Hygiene (Toller (O U P)

A SAND WATER FILTER

A common method of purifying water—by filtering through graduated layers of sand and stones over an area of about an acre.

those produced by certain micro-organisms are the most important, namely, typhoid, dysentery and cholera. Such diseases are water-borne diseases. Certain parasitic worms and their larval forms may also be harboured in impure water, and lead may be present in poisonous quantities.

Water-borne Diseases.

From a superficial examination of the colour, taste and general appearance of water very little can be learnt as to its fitness for consumption. A thorough bacteriological and chemical analysis is necessary, and this should be entrusted to skilled and competent investigators.

Local authorities are given wide statutory powers to ensure a pure water supply, and owners of premises may be compelled to provide it if not already in existence. In new houses in London and districts it is usually necessary to obtain a certificate that an adequate water supply exists

REFUSE, SEWAGE AND DRAINAGE

As people tend to live more and more in communities, so the need arises for arrangements for the disposal of their excreta, of the waste water from their houses, and of the dry refuse (ashes, dust and waste food). Clearly, the health of the community will depend very largely on the efficiency with which these materials are carried away from dwelling places.

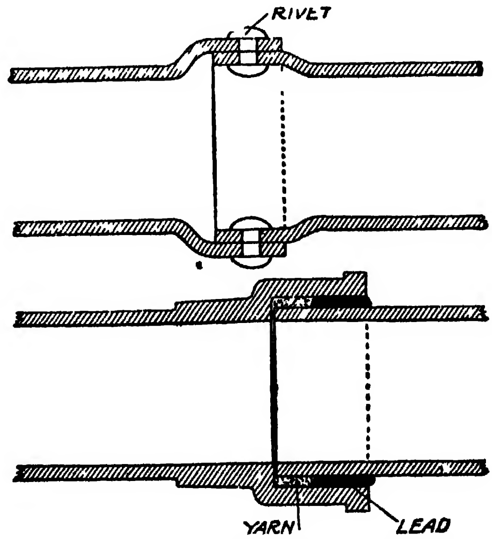
What is usually done is not to collect these three classes of material separately, but to combine the first and second for purposes of removal and disposal, the resultant waste mixture being known as sewage.

Water-Closets.

The apparatus used for the collection of excreta is generally placed in an apartment known as the water-closet. This should be situated so that at least one of its walls is an external one abutting upon an open space. In this wall there should be a window, and the actual entry into the closet should be from a landing or passage, and not from another room. The necessary equipment includes a flushing cistern of adequate capacity, a suitable flushing apparatus, and a proper pan or receiver. The flushing cistern should be quite separate from the ordinary water supply, and should hold between two and three gallons. The pan should be of non-absorbent material, and immediately below it there should be a trap capable of maintaining a water seal between the pan and the drain or soil pipe to which it is connected.

Certain types of closet comply with these requirements, and are therefore said to be good types of closet. Of these the most commonly used is the "wash-down" type.

From the closet a pipe known as the soil pipe conveys the waste matter to the drain



THE JOINTS OF A WATER MAIN

Cast-iron pipes, with absolutely water-tight joints, prevent contamination of the water supply.

[Sport & General

WHERE LONDON OBTAINS ITS WATER
Pumping station and filter beds at the Metropolitan Water Board's works at Hampton.

outside the house. This pipe should be placed away from the sun and outside the house, except in very cold localities, where there is some risk of freezing. In this instance it must be encased in wood and kept as far away as possible from the living-rooms.

While the lower end of the soil pipe is carried down into the house drain, the upper end should be carried above the eaves of the house, and there covered with a grating. In this way free ventilation is ensured throughout its length.

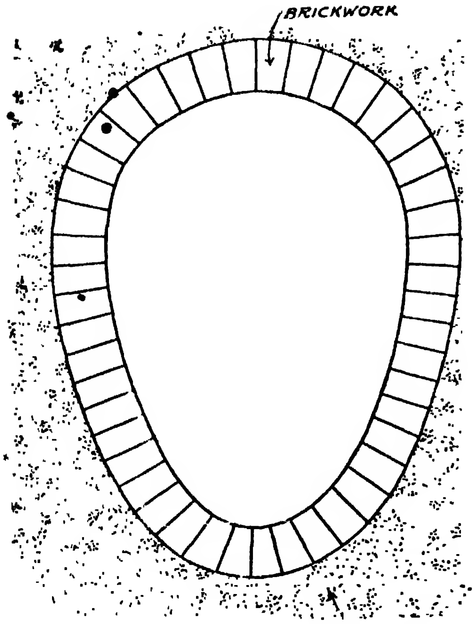
The soil pipe eventually enters into one common pipe, which also receives the waste water pipes from baths, lavatories and sinks. This common pipe, the house drain, is part of the property and must be kept in repair by the owner, whilst the sewer, into which it finally discharges its contents, belongs to the local authority, and is kept in repair by that body.

The house drain consists of sections of earthenware or cast-iron pipes, and has a gentle slope from its commencement at the house to its ending in the sewer. Inspection openings are provided at intervals in it, and the house fittings and house drain may be tested for leaks by forcing various odorous substances, such as creosote and oil of peppermint, throughout the system, any leaks being revealed by the odour escaping therefrom.

Drains.

When the drains are defective, noxious fluids, gases, solids and bacteria are not confined to the interior of the channels, but are allowed to escape into the air to be breathed, or even into the soil and water.

This reacts unfavourably upon the health of the inhabitants, in many cases only to the extent of a general impairment of health. In other cases, however, specific diseases, such as typhoid and diphtheria, are directly due to faulty drainage. In particular, typhoid fever has sometimes been traced directly to the drinking of water contaminated by a defective drain.



SECTION OF A LARGE SEWER
The sewer, which is made of brick set in cement, is egg-shaped in cross-section to allow for any sudden increase in the volume of the sewage.

"Sore throat" is so frequently found associated with bad drainage that there seems no doubt that the one is directly caused by the other. Here the infection is probably to be found in the polluted air.

Medical practitioners frequently refer cases suspected to be of this type to the Medical Officer of Health in order that the drains may be subjected to examination.

The channels provided for the collection of drainage from premises in any district are known as sewers. They may be large earthenware, reinforced concrete, or iron pipes, and smaller sewers join up to form larger sewers, and so on. Large sewers must be made of brick set in cement. The sewer has a gradual downward inclination, and in order to accommodate itself to variations in the amount of sewage, its channel is egg-shaped on cross section.

This is especially necessary in the case of "combined" systems of drainage, *i.e.*, when both rain water and sewage are carried away by the same channel. Here any sudden increase in rainfall will find corresponding room in the gradually increasing width of the sewer.

Sewers are inspected at frequent intervals by means of manholes let in from the street above. Having collected the sewage it is incumbent upon the local authorities to dispose of it in some way, and in the case of coast towns this is done by the simple method of discharging it into the sea, at a point well below the lowest low-water mark. Inland towns are not allowed to discharge their sewage in a corresponding manner into rivers until it has been purified—this is provided by the Rivers Pollution Prevention Act, 1876.

Sewage Disposal.

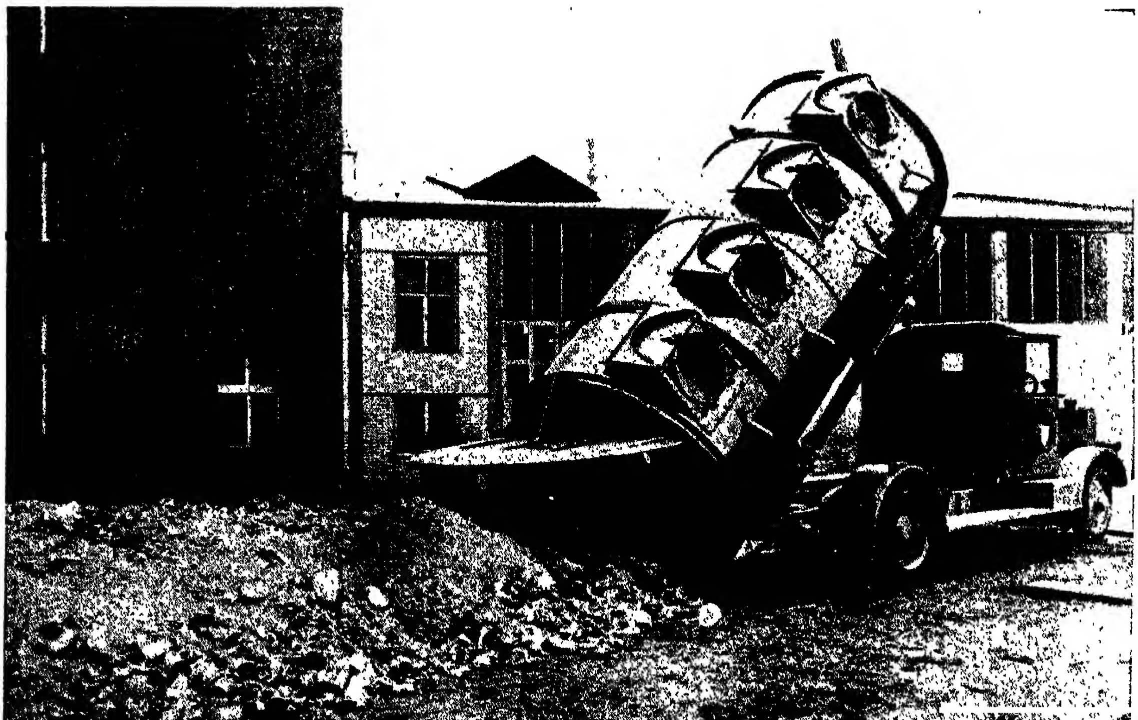
Sewage is purified by various mechanical filtration and chemical processes which are applied to it. It is first passed through settling tanks, and is then subjected to the action of chemicals such as lime or alum. In many cases this does not purify the sewage sufficiently to allow of its discharge into a river, and it is therefore necessary to treat it still further by filtering it through the soil. In this way the so-called "sewage farms" come into existence, and various vegetables may be grown on them. No vegetables which are eaten raw should be grown on these farms, owing to the risk of spreading parasitic infections, such as hookworm and tapeworm diseases.

Scavenging is the term applied to the mechanical removal of ashes, dung, waste food and dust, and in communities the local authority arranges for the removal of these waste products. In country districts the occupier himself is usually responsible for their removal.

The general requirement now is that the collecting apparatus should consist of a suitable dust-bin, fitted with a cover. This should be kept outside the house, and in such a position that there is no risk of smells penetrating indoors. It should be periodically cleaned and sprayed with carbolic powder in order to minimise the multiplication of flies.

In most districts a weekly collection of refuse is the rule, but a far more sanitary arrangement is that this should be done once a day. Generally speaking, after collection the refuse is burnt in special apparatuses

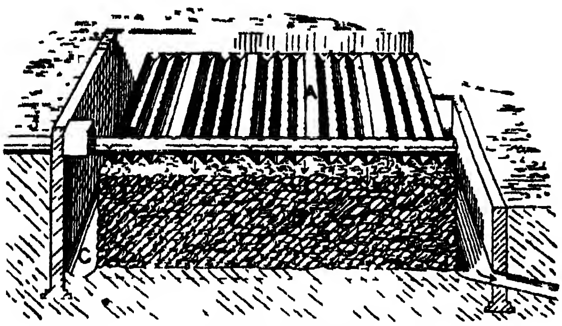
[Keystone



[Photopress

SCAVENGING—THE OLD AND THE NEW

The old-fashioned open cart allowed dirt and germs to escape during collection and removal; with the new types of covered motor vehicle the refuse can be tipped in at the sides and quickly emptied.



Courtesy] [" Elements of Hygiene" C Porter (O U P)

DIAGRAM OF A SEWAGE FILTER

The sewage passes from the perforated channels (A) through the filter medium (B) and into the channel (C)

known as destructors, each destructor consisting of one or more furnaces.

AIR AND VENTILATION

Under ordinary conditions, air is found to consist of a mixture of gases, containing:

		Per cent
Oxygen	.. ..	20.94
Nitrogen	.. ..	79.03
Carbon Dioxide	..	0.03

Small quantities of other rarer gases are also present.

Oxygen is, of course, necessary for the proper functioning of the respiratory processes, and the effect of respiration is to reduce the oxygen to 16.4 per cent. and to increase the carbon dioxide to 4.38 per cent.

Apart from being present in this way in expired air, carbon dioxide is also produced by all forms of combustion and decomposition, and is being given off constantly by the soil. The amount of this gas in the atmosphere would tend to increase enormously were it not for its absorption through the action of plants under the influence of sunlight. Its amount is increased in densely populated areas and in badly ventilated rooms.

In itself, an increase of carbon dioxide in the air, even up to 5 per cent., is not injurious to health, but other factors which invariably accompany this increase are inimical to health. These are a corresponding diminution in oxygen, the addition of heat and gas vapours, and the general stagnation and lack of movement in the air.

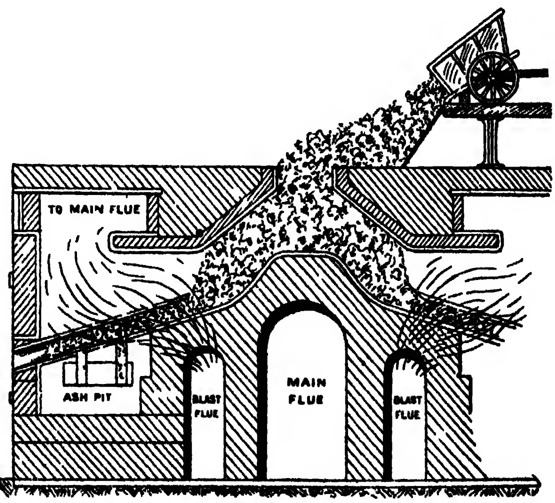
It becomes clear, therefore, that from the point of view of public health, a high percentage of carbon dioxide in the air affords an indication that the air is polluted or that ventilation is inadequate, and this percentage can actually be measured by various chemical methods.

Dust. Dust consists of minute particles of inorganic and organic matter, micro-organisms and carbon particles caught up by the wind and carried from place to place. Its presence is of some importance in industrial areas where large amounts of smoke and carbon are thrown out from many furnaces and fires; many diseases of the respiratory tract are at any rate contributed to and aggravated by the irritating nature of these products.

Various occupational diseases are directly due to the inhalation of the particular dust particles present in the industry concerned —such diseases occur in coal-miners and steel-grinders.

Micro-organisms are also present in air to a varying extent, and in densely populated areas their number is enormous. Most of those organisms are not pathogenic or disease-producing, but it is always possible that the more dangerous pathogenic variety may also be present.

Normally, expired air contains no organisms, but in coughing, spitting or



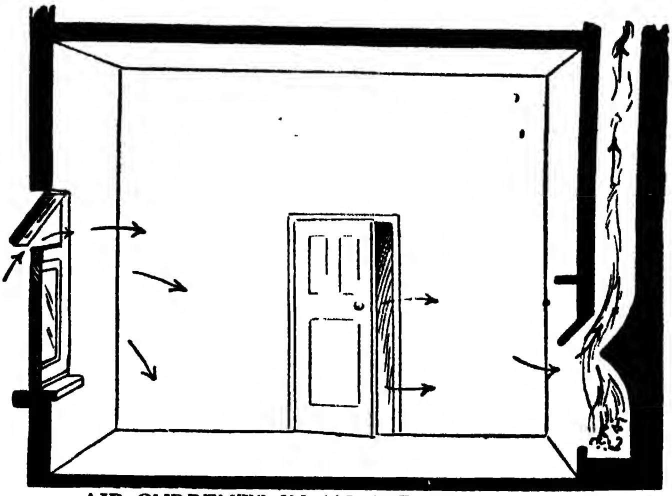
Courtesy] [" Elements of Hygiene" C Porter (O U P)

A MODERN REFUSE DESTRUCTOR

A sectional diagram of a modern refuse destructor.

sneezing, organisms may be expelled and remain suspended for some time in the air in the form of minute droplets of mucus. It is known that by this "droplet" infectious diseases such as measles, whooping cough and diphtheria can be conveyed.

Certain trades may give rise to unpleasant and offensive odours and emanations, and if a nuisance is likely to be caused, the carrying on of the trade may be restrained under certain statutory regulations.



AIR CURRENTS IN AN ORDINARY ROOM
The cold air enters to replace the rising warm air and a constant circulation is maintained.

Ventilation—or the process of introducing a continuous supply of fresh air and of removing that already vitiated—becomes a question of some importance in rooms and buildings where people are gathered together. A successful scheme of ventilation demands that there shall be no draughts, no stagnation of the air, and no undue moisture in the fresh air introduced. It is especially necessary to prevent overcrowding, and in the houses of the poor this is one of the most frequent sanitary defects, and one which takes up much of the time of the health officer. Ideally, each individual should have as much as 1000 cubic feet of air space, although in practice financial considerations necessitate a much smaller figure, *e.g.*, in tenement houses 300 cubic feet per head has been fixed as the minimum in a sleeping room.

In the case of sick people, the amount of cubic space allowed must be increased, and this must be borne in mind when considering the planning of a hospital or similar institution.

Supposing that 1000 cubic feet have been allowed for each person, the air in this space will require to be changed three times in the hour, but in cases of a smaller allowance per head more frequent changing will be necessary. It becomes clear that there will be more risk of draught in securing adequate ventilation for a smaller room than for a large one.

The hot, impure air in a room tends to rise to the ceiling, and unless it is removed, it descends on cooling and is inspired once again by the occupants of the room.

It is essential to ascertain that the whole of the air in any given room is being put in motion and changed. This can be done quite simply by holding up smoking brown paper, and observing the currents of smoke which result.

In ordinary dwelling rooms the chimney forms a sufficient ventilator in itself, without the installation of any special apparatus. With the fire burning, a current of air is maintained up the chimney, and fresh air can enter the room through the doors or windows if these are opened sufficiently. In addition, building materials are porous, and thus a good deal of ventilation takes place, insensibly as it were, through the walls, ceiling, and floor, assisted by the force of the wind blowing on one side of the building.

In apartments where people are confined together for long periods, as in factories and workshops, additional devices are employed to ensure adequate ventilation. Thus the space between the upper and lower sashes of the windows may be utilised, as in Hinckes-Birds' window ventilator.

Similarly, openings may be made in the wall, or perforated bricks may be placed at intervals round the wall at the level of the skirting. The windows may be ventilated by Cooper's circular ventilator or by the louvred window pane.

To correspond with these accessory inlets

Topical

OVERCROWDING—A CAUSE OF ILL-HEALTH
The overcrowding of slum areas deprives the occupants of adequate fresh air and ventilation.

for fresh air, outlets for the vitiated air should be made. The usual method is to carry it from the upper part of the room by means of a shaft carried upwards for some distance.

FOOD

In order to maintain health the different constituents of food should be adjusted and varied in order to produce a properly balanced system of diet. An excess of one factor will not make up for a deficiency in another—indeed, an excess of one will lead to ill-health and disease just as certainly as will deficiency of another.

The necessary constituents of food are usually classified as proteins, fats and carbohydrates, together with water and various salts and certain accessory food factors or vitamins, and a properly arranged mixed diet will subserve the general essential functions of energy production, of heat production, of growth of the body, and finally of replacement of waste tissue.

Common examples of carbohydrates are sugar, starch, cereals and others of vegetable origin. Of common proteins, such articles as meat and egg, of animal origin, occur to the mind. Certain vegetables, too, such as beans and peas contain a large proportion of protein. The term "fats" is self-explanatory.

In addition to these three factors of diet, together with a sufficient quantity of salts and water to promote the processes of digestion and assimilation, other necessary food factors or vitamins must be present. These are present in uncooked food, in vegetables, in meat and in milk. In the absence of these vitamins from the diet, certain so-called "deficiency diseases" will appear. Such diseases as rickets, scurvy and beri-beri may make their appearance in this way, and in less pronounced degrees of vitamin deficiency there may be present merely a general state of malnutrition and debility, which will be readily ameliorated by the addition to the diet of the appropriate vitamin.

It has been already indicated that the

vitamins are present in uncooked food, and prolonged boiling or stewing destroys nearly all of them, although they are not as a rule destroyed by ordinary cooking. Hence it becomes a sound practice to include in one's diet a proportion of uncooked fruit and vegetables.

Milk. Milk is in many respects a perfect food. It contains the various food factors in more or less suitable proportions, and certain vitamins are also present. The objections to its use as a staple article of diet are firstly its bulk, and secondly the many difficulties which attend the efforts to obtain a really pure and clean milk supply. The question is one of increasing importance in view of the frequency with which cow's milk is substituted for human milk in the feeding of infants. Under natural conditions of course the milk as obtained from the mother by the child is free from all forms of organic life; but where cow's milk is substituted, large numbers of living organisms may be introduced into the child's stomach, and ill-health and disease ensue. For cow's milk is an excellent medium for the growth of organisms, and is frequently responsible for the spread of typhoid fever, tuberculosis and diphtheria.

In order to improve the purity of the milk supply, more cleanly methods are necessary in the collection, storage and transit of milk. It has been demonstrated that dirt and contamination generally gain access to the milk at the farm and in the hands of the poor. At the farm much can be done by ensuring that the milker has clean hands and a clean overall; and that the cow is well groomed and has a clean udder. The pails should be scrupulously clean; the covered type shown in the figure on page 1556 should be used.

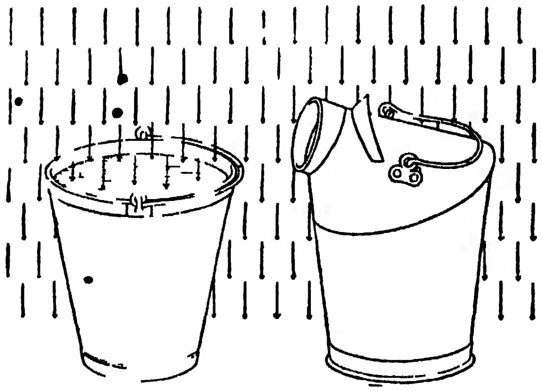
Considerable progress is being made in cases where the contamination of milk has been found to be extensive by successful prosecution under those sections of the Public Health Act.

During railway transit the milk should be conveyed in sealed dust-proof cans, and in the home every precaution should be taken

Courtesy] [*Metropolitan Vickers Electrical Co.*

A MODERN VENTILATING DEVICE

A kitchen in a large canteen with exhaust ventilation—hoods and pipes are fitted above the stoves to convey the hot air out of the building.



Courtesy] [National Milk Publicity Council

TWO TYPES OF MILK PAIL

Illustrating the advantage of the covered pail. The arrows indicate falling dust

to keep it in clean, cool, covered receptacles, away from flies and dust.

Many of these requirements are imposed upon persons dealing with milk under the Milk Designations Order, 1923, and must be complied with before a licence can be obtained. The grades of milk specified in this order are (1) Certified; (2) Grade A (tuberculin tested); (3) Grade A and (4) Pasteurised, and only persons who are licensed may produce or deal in them. The sale of milk from a cow with a tuberculous udder is prohibited.

Nevertheless the amount of graded milk sold under these regulations is a comparatively small proportion of the total amount consumed, and the bulk of the population consumes milk to which much more lenient rules apply. Later regulations, of 1926, however, impose duties on all persons concerned, and would appear to promise still greater improvements in time.

Under the Public Health (Preservatives, etc. in Food) Regulations, 1925, the addition of preservatives to milk is forbidden.

Diseased Meat.

In addition to sampling food for the detection of adulteration, food inspection is carried out with the object of preventing as far as possible the sale of unwholesome or diseased articles, and in this connection meat receives a good deal of attention. As a rule the detection of badness in meat is not a matter of great difficulty, especially if the putrefactive changes are at all advanced. Good meat should be red in colour, have a dry surface, its odour should not be offensive and its reaction should be acid. The flesh should be firm, and no fluid should exude on pressure. Meat which is becoming unfit for human consumption begins to show departures from these characteristics. Its reaction may become alkaline, its odour somewhat offensive, its colour paler, and it may exude fluid on pressure. The putrefactive odour may be sensitively detected by bruising the flesh in a glass containing hot water.

Among the actual diseases which may render meat unfit for consumption, tuberculosis is an important and prominent one. It manifests itself by large grape-like nodules in the pleura or peritoneum, and by enlargement of the lymphatic glands. Tuberculous meat of this nature may be seized and destroyed by health officers. The person in possession of the diseased meat is liable to be prosecuted, and if found guilty of knowingly selling or exposing the diseased meat for sale, may be heavily fined.

It may be noted that seizures of meat in this way can only be carried out by the proper authorities, and a private individual

A SIGN OF DISEASED MEAT

Tuberculous nodules on the membrane lining the abdomen of an ox—indicating that the carcase is unfit for consumption.

has no power to take proceedings, except by informing the Medical Officer of Health.

Anthrax may also be present in meat—the spleen of the carcase is found to be very much enlarged, and the blood contains a large number of the bacilli anthracis. Here also the carcase should be destroyed without delay.

A disease which is rare in this country is due to eating pork which has become infected with trichina spiralis, producing in man the condition known as trichiniasis. Since, however, the routine of carefully examining pork has been introduced, cases of this disease are few and far between.

Another disease in man is due to the eating of so-called "measly pork." This is pork which contains the cysticercus or embryo of the tape worm—the fully-developed worm developing later in the intestines of man. These cysticerci are to be seen in the muscle of the pig.

Although the cysticercus is readily killed by heat and cooking, infected pork should be destroyed immediately.

[Keystone

A FOOD INSPECTOR AT WORK

Testing ice cream. Food inspection is carried out for the detection of unwholesomeness and impurities as well as of adulteration.

Food Legislation.

A fairly extensive code of legislation has been evolved with regard to food, and various regulations as far as possible prevent adulteration, the sale of diseased and unwholesome food and its undue contamination and exposure.

The Sale of Food and Drugs Acts contain various provisions with regard to the adulteration of food, and other regulations lay down standards for special articles, such as butter and margarine. Under the Public Health (Preservatives, etc. in Food) Regulations, 1926, the addition of preservatives and colouring matters is an offence, except in certain specified cases.

The administration of these regulations is largely in the hands of the local health authorities; the Medical Officer of Health, the Sanitary Inspector and the Markets Inspector may submit suspected samples to the Public Analyst. Private individuals have no power to submit samples or to take proceedings but should communicate with the local Medical Officer of Health.

By the Public Health Acts it is forbidden to store, prepare, sell or expose for sale any article that being diseased, unsound, or unwholesome, is unfit for human consumption.

Wide powers are given by the provisions of those Acts to Medical Officers of Health and Inspectors to search premises, examine animals, seize unsound food and prosecute

the person having it in his possession. Before destruction a magistrate must condemn the food as unfit.

By the Public Health (Meat) Regulations, 1925, and the Milk and Dairies Order, 1926, still further progress has been made in order to ensure a clean supply of milk and meat, and their freedom from contamination.

INFECTIOUS DISEASES

When a pathogenic organism, *i.e.*, one capable of producing disease, gains entrance to the body, the individual concerned is said to have become infected. The natural resistance or immunity of the body may be sufficient to overcome this organism ; on the other hand, the powers of resistance may be low, and in this case the organisms flourish and multiply, and the disease becomes fully established.

From the point of view of public health, those diseases are important which have as a prominent characteristic the fact that they may be acquired from persons suffering from them —in other words, they are diseases which are *infectious* or *communicable*.

It is believed that all these diseases are due, in every case, to some specific organism, in some cases known and recognised, in others not known. It is further believed that none of these diseases can occur without the organism having reached the individual concerned from a person or animal already infected ; in fact there can be no case of infectious disease without a pre-existing case of the same disease. The actual process of infection consists, therefore, in the organism passing in some way or other from person to person.

Although it is frequently impossible to trace an outbreak of infectious disease back to the original infection, one must attribute this failure to the incompleteness of methods of investigation and to our present limited knowledge of organisms, rather than to suppose that there has been no primary source of infection.

Spread of Infection.

A case of infectious disease therefore demands attention from Public Health Authorities from two distinct points of view. Firstly, as a potential source of infection to others, and secondly, as a case for investigation, in order to discover the mode of spread of the infection from its original source. There are several modes of spread which may account for this infection.

INHALATION may be responsible. By this is meant that organisms leave the infected person by coughing, sneezing or spitting ; or that they leave his skin, or are blown by winds from sewage and dust ; or that they leave his body by the various discharges therefrom. They may lie dormant and inactive for long periods in clothing and furniture, and then be carried into the air By one of these means eventually the organisms are inhaled by another person, and, if conditions are favourable for the growth of this organism, the disease is finally reproduced. Diseases in which there is some affection of the throat and air passages—scarlet fever, diphtheria, pneumonia, measles, and whooping cough—are amongst the conditions spread in this manner.

Infection may also be spread by FOOD AND WATER. Milk, for example, is a common vehicle for harbouring the organisms of tuberculosis, diphtheria

Courtesy] [*National Milk Publicity Council*

GOOD AND BAD TYPES OF MILK JUG

Left : Two jugs difficult to cleanse thoroughly and cover completely. *Right :* a good type of jug.

and scarlet fever. Similarly, water may be polluted by the excreta of patients suffering from dysentery, typhoid or cholera, and thus act as a means of conveying the infection.

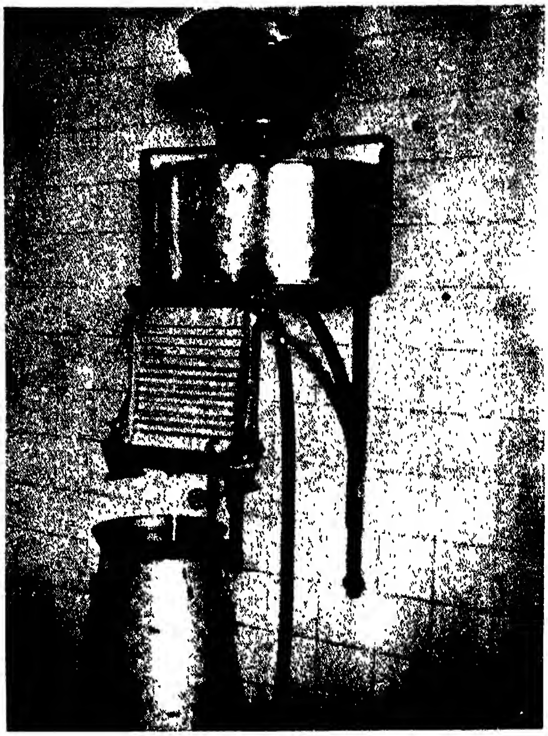
Various BITING INSECTS, also, may convey infection, such as the louse which conveys typhus fever, the mosquito which spreads malarial fever, and others more especially important in tropical countries. Such insects are "carriers."

Certain other "carriers" of disease exist, more particularly HUMAN CARRIERS. These are persons who harbour the organism in their bodies for some time after recovery, or perhaps after a mild unrecognised attack of the disease. Indeed, they may possess a natural immunity to the particular disease and harbour the organism with impunity. Nevertheless, they are able to infect others. Diphtheria carriers are a good example of infection by this method--here the organism is harboured in the throat. Patients who have suffered from typhoid fever may still have the typhoid bacillus present in their discharges for long periods after their recovery, and the Medical Officer of Health has power to prevent such "carriers" from engaging in the handling of food.

PERSONAL CONTACT is responsible for the spread of some skin diseases, such as ringworm and scabies; such diseases are said to be contagious.

The period of time which elapses between the reception of the infection and the manifestation of the symptoms is known as the "incubation period," and this is more or less constant for each particular disease. During this time the organisms are engaged in producing toxins or poisons, until finally these are produced in sufficient amount to overcome the resistance of the body, and so finally symptoms of the disease become apparent.

The importance of bearing in mind the incubation period of each disease becomes clear when the question of dealing with "contacts" arises. A "contact" is one who has been exposed in some way to possible infection with a disease, and, administratively speaking, it becomes necessary to isolate such a person for a time corresponding to the incubation period of the particular disease. After that time he may be allowed to pursue his way without any fear that he may develop the disease and help to spread it.



A HYGIENIC MILK COOLER
Milk entering the milk room through a sterilised tube and passing over the cooler into the delivery can.

Immunity.

Immunity has already been referred to, and means the resistance which an individual has to infection. It is of two main types, natural and acquired. Natural immunity is found in certain tropical countries, where the natives are not susceptible to certain tropical diseases, although strangers to these countries readily acquire them. This would appear to be more in the nature of a racial characteristic. On the other hand, immunity may be acquired in several ways :—

(*a*) By an attack of the disease itself. This usually protects the individual against a second attack.

(*b*) By deliberate inoculation with a mild form of the disease, as *e.g.*, in vaccination.

(c) By the injection of antitoxins derived from another animal who has acquired immunity.

In order that the local authority may take any necessary steps to deal with an outbreak of infectious disease as soon as possible, a system of notification is imposed by the Infectious Disease (Notification) Acts. Under these regulations the medical attendant on such a case must notify its presence to the Medical Officer of Health. The head of the family or occupier of the premises is also liable to a penalty of 40s. for failure to notify under these regulations, but in actual practice it is the medical attendant who notifies.

The diseases to which the provisions of these Acts apply are: smallpox, cholera, diphtheria, membranous croup, erysipelas, scarlet fever, typhus fever, typhoid fever, continued fever, relapsing fever and puerperal fever. These are the "notifiable" diseases, but the list may be added to by the local authority. Such a disease as chickenpox may be made notifiable when small-pox is epidemic, so that complete control may be had over the main disease, and cases of doubtful and difficult diagnosis between the two diseases covered by this double notification.

Other diseases which have been added in this way are anterior poliomyelitis, cerebrospinal meningitis, ophthalmia neonatorum and encephalitis lethargica ("sleepy sickness").

When an infectious disease has been diagnosed, removal to an insolation hospital is by far the most satisfactory method of dealing with it. Attempts to carry on an efficient system of isolation in the patient's home are usually inconvenient and ineffective, and details are frequently neglected. Removal to an isolation hospital may be resisted by the patient or his relatives; under these circumstances, the Medical Officer of Health can obtain an order for removal from a magistrate if he certifies that there would be a risk of spread of the disease in the event of the patient being allowed to remain at home.

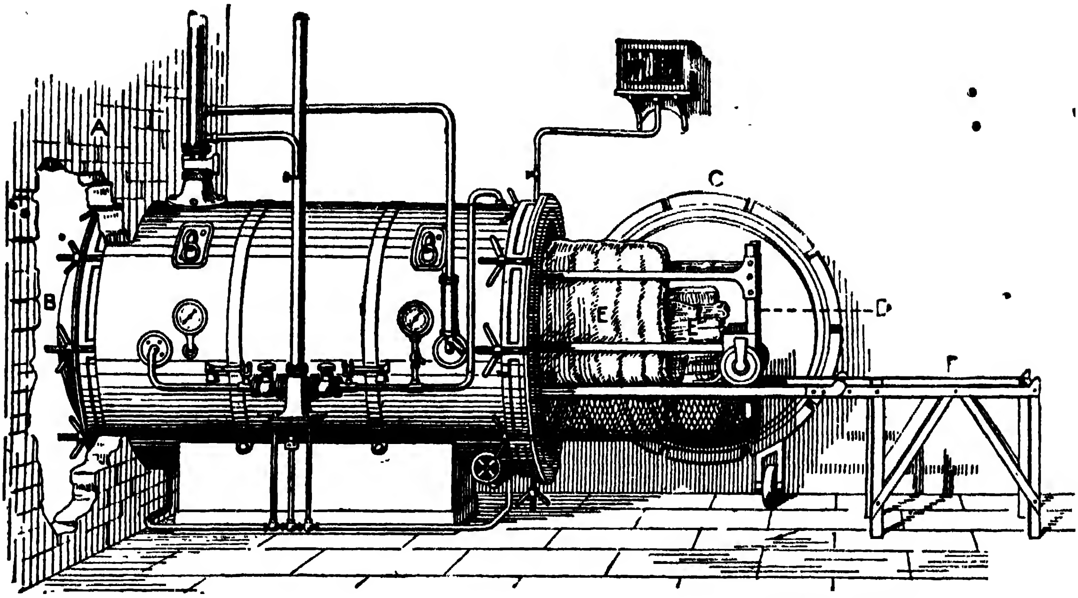
In cases of epidemics of measles and scarlet fever, it sometimes becomes unavoidable to treat a proportion of the cases at home, owing to the limited isolation accommodation at the disposal of the local sanitary authority. In such cases any occupation which deals with food or clothes must be discontinued; school children in the family must cease to attend school; and people in the house whose work brings them into contact with children must discontinue their work. Risk of carrying the infection is thus minimised.

Disinfection is the process of killing the organisms of a disease. These are to be found in the room occupied by the patient, in his bedding and clothing, and indeed in any article that he may have used. The proper time to carry out this process is after the patient has been removed to hospital, or, if he has been treated at home, after he has recovered. Various physical and chemical germicidal agents are used for this purpose, and, whatever actual agent is used, there should follow free exposure to air and sunlight—since the infective micro-organisms soon die out under these conditions. During the actual progress of the disease all infected discharges and soiled articles of clothing and bedding are subjected to disinfection.

Disinfection.

Infected articles of little value are best burnt, as for example, soiled mattresses after smallpox. Articles which can be boiled easily and without being harmed should be treated in this way—such as sheets and towels. Few organisms can survive exposure to the temperature of boiling water for a short time. Larger articles require treating by steam in a special apparatus known as a disinfecting chamber. This is installed by the Public Health Authorities, and articles are treated in it free of charge and as a routine, at any rate as far as the notifiable diseases are concerned. Equally gratuitously the local authority collects these articles in a special vehicle, disinfects the room or rooms, and returns the clothing and other articles after treatment at the disinfecting station.

For the actual treatment of the infected room the method most frequently employed



Courtesy] [" Elements of Hygiene " C. Porter (O.U.P.)

A STEAM DISINFECTOR

After disinfection the articles are discharged through the wall (A) into a separate room; (B) and (C)—doors on disinfected and infected sides; (D)—cradle containing articles (E) to be disinfected, and moving on detachable rails (F).

is by diffusing formalin vapour throughout it. The vapour is obtained by heating "paraform" tablets over a spirit lamp. Before vaporising, the windows are made as tight as possible, and the chimney stopped up. All cupboards and drawers are opened, and bedclothes exposed. After the vapour is liberated the door is locked, and the room left under the action of the disinfectant for at least twelve hours.

In the case of all these infectious diseases the local authorities take such steps as may be necessary in the public interest, such as isolation, disinfection and the quarantine of contact cases. In the case of one disease, however, the law enforces a specific prophylactic or preventive measure. This disease is smallpox, and the law demands that except in certain cases of conscientious objection or medical inexpediency, all children should be vaccinated.

Vaccination. Under the Vaccination Acts every child must be vaccinated before it reaches the age of six months. There are three exceptions to this general rule, exemption being granted :—

(1) If a medical certificate is sent to the registrar to the effect that the child is not in a fit state to be vaccinated or that the operation is undesirable on other medical grounds. Postponement in this way cannot be for more than two months at a time.

(2) If a medical certificate is sent to the registrar stating that the child has been vaccinated three times and that the operation has not succeeded, and that therefore the child is not susceptible, or that it is not susceptible because it has already had smallpox.

(3) If the parent or guardian of the child declares on oath before a commissioner for oaths or a magistrate that he conscientiously believes that vaccination would be prejudicial to the health of the child. This statutory declaration must be made before the child reaches the age of four months. Under this last provision a large number of exemptions are obtained.

There can be no doubt of the efficacy of successful vaccination in preventing the incidence of smallpox. Statistics of numerous outbreaks of the disease show that it attacks almost exclusively those who

have not been vaccinated, and that those vaccinated who do acquire the disease get it in a very much milder form. It was shown in an epidemic in Sydney, in 1913, that even the unvaccinated who had been in contact with the disease were completely protected if vaccinated within two days of exposure to infection. Six thousand such cases of contact were vaccinated—not one of them developed the disease.

The immunity which this vaccination in early infancy confers is limited, and probably does not last more than about fifteen years. Therefore re-vaccination is advised at some time during adolescence and at intervals afterwards. Especially is re-vaccination demanded on the occurrence of an actual case of smallpox; in this case the immediate re-vaccination of the other inmates of the house is necessary.

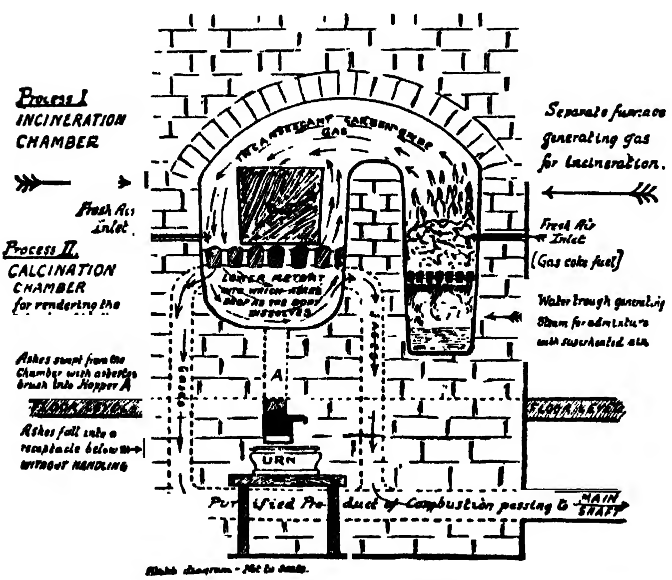
Many outbreaks of smallpox have been traced to tramps and vagrants—a class of people who are practically exempt from sanitary supervision. To meet this danger, the local authority is empowered to require a medical examination of all persons entering common lodging houses and casual wards, and to enforce the temporary detention of all smallpox contacts of the vagrant class.

DISPOSAL OF THE DEAD

It is now generally recognised that it is undesirable to retain dead bodies for longer than necessary amongst the living and that disposal should take place as far as possible from human dwellings.

Cremation is undoubtedly the most sanitary method that can be employed. By this means the body can be reduced within the space of two hours to a small amount of odourless ash, which can, if the relatives so desire, be preserved. This method also has the advantage of obviating pollution of the ground—a matter of some importance if the disease causing death is of an infectious nature.

By the Cremation Act of 1902 no body may be cremated unless two separate certificates as to the cause of death have been furnished. These certificates go before a medical referee, who, if satisfied, will allow the body to be cremated. He may, however, require a post-mortem examination to be made, and if this is refused, cremation may not take place.



Courtesy] *[Cremation Society of England*

A CREMATORIUM FURNACE IN SECTION

Showing how incineration is effected by incandescent gas without contact with the furnace, enabling the ashes to be withdrawn absolutely pure.

As regards ordinary earth burial, great care is required in choosing a site for a burial ground. Its position in relation to dwellings and the direction of any drainage from it requires careful consideration.

Cemeteries may not be placed within 200 yards of a dwelling unless the owner gives consent. Precautions must be taken against contamination of water and soil by providing adequate drainage. A dry soil is best. Overcrowded graveyards may be closed by an order of the Ministry of Health, either on account of congestion and disturbance of old graves by the digging of new, or because they are offensive, injurious or dangerous to the health of people living near them.

Courtesy] [*Cremation Society of England*

A MODERN CREMATORIUM

The Golders Green Crematorium, with chapel, memorial cloisters, columbarium and "garden of rest."

PUBLIC HEALTH AND LAW

A large volume of statute law has arisen as the result of the various provisions which have been made from time to time in the interests of public health. Undoubtedly the foundation of law of this nature was the Public Health Act, 1875. This consolidated the law with regard to Public Health in England, and in it power was given to appoint Medical Officers of Health and Sanitary Inspectors. It also dealt with sewerage and drainage; scavenging and cleansing; water supply; nuisances; infectious diseases and hospitals.

The later Public Health Act of 1925, gave power to local authorities to carry out cleansing of verminous persons, and gave additional power to prevent the contamination of food. It also empowered these authorities to close common lodging-houses in cases of infectious disease. Provision is also made by this act for allowing local authorities to arrange for teaching and propaganda on health matters generally.

Public Health (Amendment) Acts were passed in 1890 and 1907, to remedy certain defects in the original act of 1875. In the act of 1907 provision is made for requiring dairymen to supply information as to sources of milk supply, and upon laundrymen and principals of schools to supply lists of customers and scholars respectively in order to assist the Medical Officer of Health in the prevention of the spread of infectious disease. Under this act also the use of library books is forbidden to infected persons, arrangements are made for the accommodation of contacts with infected persons, and for disinfecting premises where necessary.

The Infectious Disease (Notification) Act and the Vaccination Acts have already been referred to under the heading of Infectious Diseases.

The Housing Act, 1925, made important provisions in regard to the improvement of housing. Local authorities are empowered to close and demolish houses unfit for habitation and to clear overcrowded areas.

Various Sale of Food and Drugs Acts have been passed from 1875 onwards to ensure that only foods and drugs of proper quality shall be sold, and provision is made for the

Medical Officer of Health and his Sanitary Inspectors to take samples and submit them to the Public Analyst.

The Factory and Workshop Act of 1901, and subsequent amending and consolidating Acts cover the measures that are necessary for the protection of workers from harmful influences that may exist in the factory or workshop. These Acts enforce the notification of certain trade diseases.

The Midwives Act, 1902, and the Midwives and Maternity Act, 1926, regulate the practice of midwifery by certified midwives and regulate the carrying on of registered maternity homes.

Under the Notification of Births Act of 1907 and the subsequent Notification of Births (Extension) Act of 1915, information must be given to the Medical Officer of Health within thirty-six hours of the occurrence of the birth of a child, alive or dead, born after the twenty-eighth week of pregnancy. This must be done by (*a*) the father, if residing in the house at the time of birth; and (*b*) any person usually the medical attendant in attendance on the mother at the time.

The Maternity and Child Welfare Act of 1918 empowered local authorities to make arrangements and provide centres for the work of maintaining the health of mothers and of children.

Various bye-laws, too, are made from time to time by the local authority, and when they are approved by the Minister of Health, they become operative in the district concerned Such bye-laws relate to matters such as drainage, lodging houses, slaughter houses and offensive trades.

PERIODIC MEDICAL EXAMINATION

It is a truism that prevention is better than cure. Nevertheless, it is being suggested in various quarters with increasing emphasis

Courtesy] [Garden Cities & Town Planning Assoc

THE IMPROVEMENT IN HOUSING CONDITIONS

Types of houses built according to byelaws in Manchester between 1845 and 1922—the tendency being gradually to eliminate overcrowding.

Courtesy] [J. Lyons & Co.

DENTAL INSPECTION IN A FACTORY

The dental surgery at the works of Messrs. Lyons & Co. where periodic examination is undertaken.

that the present contractual relationship between the medical practitioner and his patient is fundamentally unsound. It is suggested that so far from being called into consultation when the patient is ill, the medical practitioner should undertake at frequent intervals to examine his patients thoroughly, to diagnose any incipient disease, and to suggest any necessary treatment; in fact, to keep them well rather than to be called to attend them only when the disease process is distressingly obvious, is well advanced, and frequently incurable.

Such a relationship is already recognised in the analagous case of the dentist—for his periodic dental examinations are well established as a hygienic and salutary proceeding.

In this country at present this ideal has not made great progress, but in the United States of America definite progress is being made along the lines indicated.

A start is being made in the right direction by employers of massive labour in many industries. Here it is being gradually realised that it is better, both for the employer and the employee, that the latter should be maintained as a healthy and efficient industrial unit by periodical examination by the medical staff attached to the firm. Especially is this system of value in detecting early symptoms of the so-called "industrial diseases" such as those inflammatory conditions of the skin ("trade dermatitis") which attack the workers in various trades.

Better organised facilities are needed to allow the medical profession as a whole to co-operate with the organisations that already provide these examinations, so that the public may obtain general instruction and guidance in hygiene and information as to necessary medical treatment.

The actual physical disabilities that may be discovered in this way are not revealed in any morbidity report or even in a house to house sickness survey, but can only be discovered by actual physical examination. Such common and remediable defects as bad teeth, flat feet, errors of refraction, early cancer, unobserved loss of weight, hernia,

tuberculous disease, varicose veins and foci of septic infection generally may be detected in this manner.

At the University of Wisconsin as the result of periodic medical examination applied to the students, it was found that the loss of time due to illness was reduced by 50 per cent. owing to the early treatment of preventable conditions. During eight years of this system of supervision the university death-rate has been reduced to so low as one-fourth of the general death expectation of the same age period, and even the death-rate from the recent influenza epidemic was only one-fourth of the general death-rate attributable to the disease. Frequent consultations have reduced serious illness and its complications by at least 50 per cent.

The physical sufficiency of civilised man is very much taken for granted until, as in the case of war, some unusual demand is made on him. His physical inefficiencies then become glaringly apparent, and one of the outstanding lessons of the late war was the enormous frequency of these latent pathological conditions in men presenting themselves as recruits for the army.

To quote from the report of the committee of the Ministry of National Service :—

" Of every nine men of military age in Great Britain, on the average three were perfectly fit and healthy ; two were on a definitely infirm plane of health and strength, due to some disability or failure in development ; three were incapable of undergoing more than a moderate degree of physical exertion, and could almost be described as physical wrecks ; and the remaining man as a chronic invalid, with a precarious hold on life. . . . This stocktaking has brought us face to face with ugly facts and—one hopes—awakened us from the half-hearted complacency with which in the past we have treated our most important asset, the health of the nation."

It is clear that any further progress to be made in public health will largely depend on educating the general public up to a standard whereby they may understand the causation of disease and the ordinary measures by which it can be prevented, and considerable progress is now being made along the lines of education. By means of popular lectures and literature the public is beginning to appreciate the importance of having regard to the laws of health and personal hygiene. Although it is not always the weak and unhealthy, the poorly fed, and the badly housed who are attacked by disease, yet in this connection there are advantages in health, strength, good housing and good food. Health as a protective is worth preserving, and it must be emphasised that resistance to disease may be lowered by neglect, indiscretions in diet, over-indulgence in alcohol, and indeed, excesses of any kind. Exposure to wet and cold, overcrowding and bad housing conditions generally, all tend to lower the natural immunity of the body.

Health Education.

HEALTH EDUCATION OF THE PUBLIC

By Professor W. A. EVANS, M.D., M.S., Dr.P.H., LL.D., Health Editor of the " Chicago Tribune " and other journals, Member of Advisory Boards of Health of Illinois and Cook County, Ill., Professor of Public Health, North-Western University Medical School.

I DOUBT the value of any opinion as to the best methods of health education of the public. The method which is best with one group of people is not the best with another. A method which is best when it is novel may not even rank as a good method when it no longer has the quality of novelty. The fact is, such methods belong in the field of salesmanship. Their psychology is that of salesmanship. It is a well-known fact that salesmanship must not be allowed to crystallise. To be successful it must be kept labile. The salesman must be a good diagnostician, a man of judgment and quick decision, and he must change his method as the need arises.

For those who are interested in the varied experiences of many people, with many methods, I commend a systematic reading of the proceedings of the section on Public Health Education—organised to supply a forum for the discussion of the problems of presentation—as found in the more recent volumes of the *American Journal of Public Health.*

In this article I limit myself to a group of experiences in popular education in health, of which I can write by drawing on my own observations and opinions.

Chicago Medical Council.

In 1903 the Chicago Medical Society inaugurated Saturday night lectures on health. These lectures were given in the public library. The hall was invariably filled. Such lectures are common enough now, but twenty-five years ago they were novel, at least in the vicinity of Chicago.

About the same time, or a little earlier, the weekly bulletin of the Chicago Medical Society was entered as second-class mail matter, and it began to take on some educational features, with the education of the physician as an objective.

Some time before 1900 the weekly bulletin of the Chicago Health Department began to feature health stories having a popular appeal. The statistical week closed on Saturday, and the copy of the bulletin was made up within twenty-four hours of that time. The copy was sent to one of the daily morning papers on Sunday. That paper set the story in type and supplied galleys to the other dailies, and then turned the matter over to the Health Department, to be used in printing the bulletin. The newspapers used such of the material as they cared for, or had room for. This arrangement saved money for the Health Department and obtained a great deal of space in the papers for the contents of the bulletin.

An Educational Institution.

In 1907 the Chicago Health Department was incorporated as a teaching institution under the name of the Chicago School for Sanitary Instruction. Under this arrangement the bulletin was accorded second-class mail privileges. The trend which it has always had toward educating and interesting the general public was much more evident after this change was made.

Since 1907 the Health Department has offered opportunities for training in health department laboratory technique, and in field health department work of several types. However others may think about it, the department has always regarded the chief task of the Chicago School for Sanitary Instruction to be education of the general public. One of the activities in this direction was a press service for the foreign-language press, the neighbourhood papers, and other group organs. More than twenty-one years ago they began supplying a health story weekly. In recent years the stories supplied to the foreign-language press have been translated by the department into the language of the paper. The School organised a lyceum bureau to supply speakers on health subjects to all kinds of assemblages.

Moving Pictures.

Their method of using moving pictures had a certain merit. They made use of short reels only. The department purchased at least one copy of every such worthwhile reel available. A man with a case of reels, bearing a letter of introduction from the Health Commissioner, and wearing a star, went from one to another of the movie houses, asking permission to show one short reel. This favour was never refused. Only one reel was shown. The agent of the department then left, going to another house. By showing one short reel only, and with no warning to the audience, we obtained an opportunity to reach the indifferent people, the people who always avoid health shows, health movies and advertised long reels, as well as everything else that was suggestive of uplift.

The "Health Column."

In 1911 the *Chicago Tribune* began a department called " How to Keep Well." This was not the first health column, but it was the first with the objective and the method which has since been adopted by several hundred newspapers in the United States and Canada. The object is to make the newspaper-reading public

reasonably well informed on health so that they may have the knowledge or the judgment to select their physicians intelligently; to avoid quacks; to recognise quackery when it presents itself; to form intelligent opinions on medical matters, including proposed medical matter; to carry out the directions of physicians, particularly in chronic disorders where the carrying out of so much of the programme is dependent on the patient and his family; to know the rules of personal hygiene; to keep their bodies and their minds fit to maintain an intelligent attitude toward public health legislation and administration.

Any furtherance of patent or proprietary medicines, methods or procedures is to be carefully avoided. The readers of the column are never to be exploited directly or indirectly.

The method, or technique, consists in publishing an article of about five hundred words, and following that with enough public letters and replies to make a total of something less than a thousand words. This column appears each day in the same space on the editorial page.

The number of letters received daily varies between one and three hundred. About once every week, on an average, there will be more than three hundred letters in a daily mail, and two thousand represents the maximum number received in a one-day's mail. In the main, the letters receive a personal and signed reply.

Soon after beginning the column it was recognised that certain material could be very well put in the form of leaflets; that some questions could be answered by enclosing a leaflet. For instance, a leaflet on constipation meets the needs very well.

Booklets.

The subject of venereal diseases presented some difficulties. In order to be helpful and, at the same time, to prevent the column from being offensive to some people by frequent references to venereal diseases by name, a booklet was written. This was distributed free on request. At that early day health departments had not begun to supply booklets on venereal diseases. This booklet was given away for several years. When other sources of supply, particularly from health departments and social agencies, became readily available, our supply of this booklet was allowed to become exhausted.

The same motives were responsible for a booklet on menstrual irregularities and the menopause. This booklet is still being distributed. Many thousands have been given away. If we sold this booklet, the number distributed would entitle it to be called "one of the world's best-sellers."

A few years after these booklets began moving, an idea occurred to us. It was this: there are a number of disorders which discommode people but which in some instances have little tendency to end life, and in others, no such tendency. These diseases men live with oftentimes for a great many years. In 1897 Dr. William Osler wrote on the advantage of having chronic Bright's disease, telling of some patients of his who had lived long and useful lives in spite of their disorder.

While there is ample literature for the guidance of the physicians who treat the people with these minor disorders, there is a great dearth of literature for the guidance of the people themselves. They visit their physicians periodically, the frequency of these visits in a great measure being determined by the urge of symptoms. At the time of their visit they receive instructions—in some cases in general terms and in some cases in detail—as to how to live. But there is no follow-up system except in a few fields, and no literature that the doctor can put in the hands of the patient, or that he can get for himself as a home guide. In a few chronic disorders, as, for example, consumption and diabetes, the advantages of such guides have been proved. This caused us to start what is called the "How to Live Well" series.

Up to date, the numbers in this series are:

1. Personal Hygiene for Women. 2. Care of the Cured Consumptive. 3. Bright's Disease. 4. Epilepsy. 5. Abnormal Blood Pressure. 6. After Care of Apoplexy. 7. Advanced Locomotor Ataxia. 8. Senescence.

9. Senility. 10. Home Care in the Wake of Infantile Paralysis. 11. Heart Disease. 12. Diabetes.

When a booklet is written on a subject already well covered, such as diabetes, we try to have the text stimulate the purchase of a larger and more complete manual.

This list will be extended at the rate of two or three a year. Whenever any field is satisfactorily filled and there seems no further reason for our booklet, it will be allowed to lapse.

These booklets are sold for either five or ten cents and postage. Nos. 1 and 2 are given away provided postage is sent. We ask for a stamped, addressed envelope to save trouble for ourselves, to have the cost of purchase carried by the purchaser, and to cause the recipient to appreciate and to read the booklet. Many thousands of these booklets have been distributed on request.

Courtesy] *[Chicago Department of Health*

HEALTH INSTRUCTION BY PROPAGANDA

A typical illustration in a weekly bulletin devoted to simple health instruction issued by the Chicago Department of Health—"Every case of Diphtheria in a Family is a sign of Ignorance or Neglect."

A complete list of the leaflets and booklets not in this series is given below. Some of these are supplied by health departments. For example, we were supplied with several thousand booklets on cancer by the State Health Department. We gave them away on request, as did the department. Between us we have given away about three hundred thousand of this booklet.

Have You Cancer?
Infantile Paralysis, by the Visiting Nurses of Chicago.
Our Babies.
Keeping Fit.
Diet Lists for Infants and Children.
Bed-wetting.
Tobacco Cure.
Cigarette Cure.
Karrell Milk Diet.
Thread Worms.
Head Lice.
Poison Ivy
Mosquito Repellents.
Reducing.
To Gain Weight.
Warts.
Eczema of the Hands.
Danish Itch Remedy.
Itch Remedy.
Constipation.
Pimples and Blackheads.
Boils.
Nail Biting.
Perspiring Feet.
Dandruff.

A part of the request which initiated this

article was that the methods described were necessarily some employed in the United States, and "yet they should be educative in a general way to our people," meaning the people of Great Britain. I will not say whether what is here described could be applied in Great Britain. British opinion on that point would be far better than mine. I will say that at the beginning there was a large body of opinion that the methods would not succeed in the United States. Time has proved that opinion unsound. However, there are still many who do not approve of what has been done. Those who weigh what is here written should know of this opposition and should give it due weight.

THE DAY NURSERY AND CHILD WELFARE

By THE VISCOUNTESS ERLEIGH, Vice-President of the National Society of Day Nurseries.

THERE exists in all industrial countries, and possibly to a lesser extent in others, a class of mother and child that is apt to be passed over by the Child Welfare Institutions. This class consists of those women who are mothers and are yet obliged to go out to work, and their consequently neglected children. The woman who has to be at her work by 8 a.m. and does not reach home until 6 or 7 p.m., has no time and opportunity to attend an Infant Welfare Centre; nor will the Health Visitor find her at home when she calls. Her sole free time, if free time it can be called, with the week's marketing, washing and household cleaning that must be done, is on Saturday afternoons and Sundays, when Infant Welfare organisations do not function.

Working Mothers.

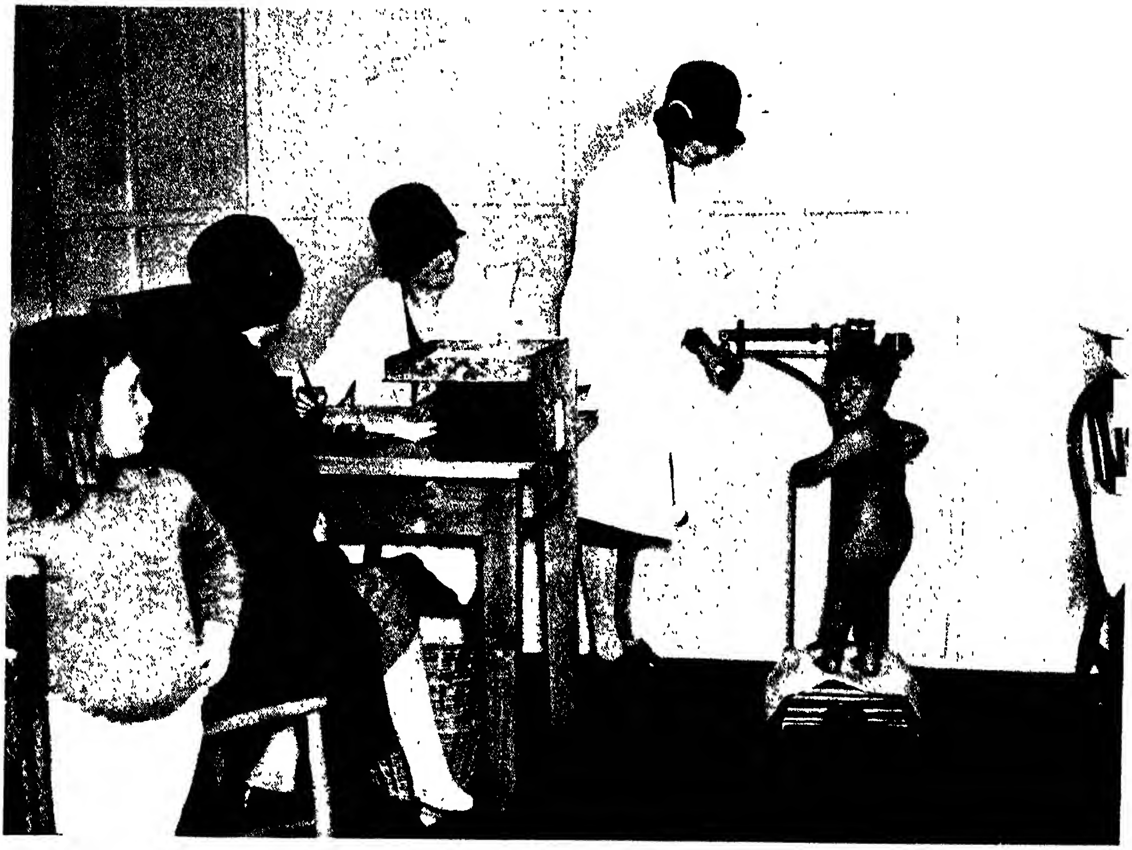
It may be argued that women should not go out to work, but the fact remains that they do, and as things are at present, they have no other alternative. The woman whose husband is unemployed or sick, or, as sometimes happens, in gaol, must work herself, as unemployment or sickness benefit do not bring in enough for her to do more than barely live. A widow's pension in England, too, is not sufficient to allow of her remaining idle; and there are, besides, many wives deserted by their husbands who have to provide single-handed for a large family, and also the unmarried mother with a child to support. In addition, there are certain trades dependent on women's labour, and a class of women that has for generations supplied that demand, as also a great number of casual occupations, such as charwomen, office cleaners, etc., that are filled by women.

In many cases, the woman in reality supports the entire family—five or six children and her husband—when, for example, the husband is suffering from some chronic disease which renders him unfit for regular employment.

The children of such women who are too young to attend school suffer greatly from neglect. They do not benefit from regular attendance at Welfare Centres, as there is no one to take them; they are left to the care of an already overworked neighbour, or an old, and sometimes bedridden, grandmother, or farmed out for the day to some ignorant woman. It does even happen that quite tiny children of two or three years are left entirely alone all day, locked into their home, and tied to the leg of a table for safety.

There is only one method by which these children can be reached, and through them their mothers, and that is by the Day Nursery or Crèche. Once in a Day Nursery, the child is properly fed and looked after; the mother, when she brings and fetches the child, is seen by the nurse, and has gradually instilled into her correct principles of child hygiene.

The Day Nursery is the only way of salving the good material that is going to waste in these children, and the only way to prevent a gap in the Infant Welfare Scheme of any industrial district: they should, therefore, form an integral part of any organisation for Infant Welfare. This has been recognised in many countries, though not as widely as it should be, and the provision of Day Nurseries is, in general, very much below what is required. It is now time that the provision of these institutions should be on as adequate a basis as that of the Infant Welfare Centres.



[Photopress

A QUESTION OF WEIGHT
Children being weighed and examined at the Chelsea crèche and welfare centre.

One of the reasons why the Day Nurseries have not grown commensurate with their need is due to the cost of maintenance in the past. It had been thought that when young children between one month and five years were to be placed together the number must be very restricted. This made the overhead charges very high, as a competent matron must be in charge whether there are thirty or a hundred children ; rent, lighting, fuel, etc., are all multiplied in a number of small institutions.

Since the discovery that the risks of infection are enormously minimised by an open-air regime, and that young children can stand, and indeed benefit, by such a regime, there is no longer any need to place such restrictions on the number of children in any one Day Nursery, provided it is run on open-air lines.

Miss McMillan's Nursery School has over 300 children between the ages of two and five years, and a marvellous health record. The Sun Babies' Day Nursery accommodates 100 from one month to five years old.

Education.

The modern Day Nursery is not merely a place where children are fed and kept in safety while their mothers are at work, it is an educational centre in the widest sense of the term. At the most formative period of a child's life—up to five or six years old—recognised by all authorities as the supremely important period, the child is trained in correct habits of bodily function, in principles of cleanliness, of order and decency, is given freedom to develop its growing powers of body and mind in an environment carefully planned to that effect.

The formation of bad habits is checked at the outset, and by the time the child passes to school life it is physically and mentally prepared to benefit from the education it will

receive. The good results from correct food and clothing, fresh air, and an ordered life are made apparent to the mother of the children in the most convincing manner. These mothers do much indirect propaganda among the other mothers in their district.

The Day Nurseries are also most valuable training centres for young girls who wish to become nurses, or take up Child Welfare work. The practical experience gained in a large nursery of normal, healthy children is invaluable; attention to minor ailments, and the early detection of illness, so essential in such institutions, gives them just that experience necessary for nurses in private families, orphanages and various houses, for normal as opposed to sick children. Even for the girl who wishes to become a hospital nurse there is a great advantage in learning first what the normal healthy child is like.

Training Nursery Workers.

In England the practical experience in a Day Nursery is supplemented by theoretical work consisting of three courses of lectures by medical women arranged by the National Society of Day Nurseries. Certificates are granted to those who pass the examinations and have done one year's practical work in a Day Nursery. This system has been found to work admirably; the certificates are highly prized, and a constant stream of girls trained for work in Day Nurseries is assured.

Further educational work is often accomplished by arranging for girls from neighbouring schools to attend a Nursery and receive instruction in mothercraft from the matron, and see with their own eyes the benefit of modern methods to the children. Students from educational training colleges, such as Montessori or Froebel, are also glad of the opportunity to observe the children in the Nurseries.

No modern Nursery is complete without a teacher for the older children between two and five years, for preference one versed in Montessori, Froebel, or Nursery School methods. Indeed, it is difficult to distinguish between an up-to-date Day Nursery and a Nursery School. The former, of course, take babies from a month old, the latter, in England, can only take children from two years old, but they have the advantage under the present Governmental arrangements of a wider field from which to draw their children, not being restricted, as are the Day Nurseries, to those children whose mothers are out at work.

The time is coming when the Day Nursery and the Nursery School should be and will be combined, and the value of such institutions fully recognised. The wastage of golden opportunities with children below the school age is becoming every day more apparent. Teachers complain that they have to spend the first years, when a child enters the school, correcting bad habits, curing physical defects, and instilling elementary lessons of order and decency; in other words skilled teachers are used for doing work that should have been done by nurses, and much of which, with proper care, should never have to be done at all. This entails waste of effort and waste of money. The mischief lies chiefly in the unsupervised period when, after a child is one year or eighteen months old, the mother no longer brings him to the Infant Welfare consultations, and he is without proper medical supervision during the next critical three or four years until he enters school. The errors of those years have then to be corrected, and many defects are permanently established.

In the Day Nursery every child is seen regularly by a doctor, who makes arrangements when necessary for the child to attend a hospital, and gives orders for special diet or minor treatment in the nursery itself. Psychological or behaviour clinics will also in time become part of the routine of every well-conducted nursery. Already some nurseries are establishing their own artificial sunlight apparatus.

HEALTH IN THE SCHOOLS

By J. MAXWELL TAYLOR, M.A., M.B., Ch.B., D.P.H., Senior Assistant School Medical Officer, Reading.

THE health of the children of the Elementary Schools is a valuable index to the health of the country as a whole. They form, roughly, one-seventh of the entire population, and

[Central Press Photos

MEDICAL EXAMINATION IN AN L.C.C. SCHOOL

A periodic examination in the presence of the parents—testing the reflex action of the knee as an aid to the diagnosis of nervous disorder.

being collected into groups in the schools it is possible to study their general health much more readily than that of the rest of the people. Moreover, during the past twenty years, since school medical inspection was instituted, a large mass of statistics has been collected. Prior to that date little information is forthcoming.

If a school log-book of the early days of compulsory education is examined, one finds few references to the health of the children. There were the recurring epidemics of measles and scarlet fever which came along to interfere with the attendance. Indeed, the visits of the attendance officer are one of the features of the log-book. As in Shakespeare's time, the schoolboy apparently still went

> " creeping like snail,
> Unwillingly to school."

In those days, too, discipline was difficult to maintain. One reads of the boys being " noisy and unruly, especially when there are visitors about." " They need more drill and much tighter discipline." In a girls' school, it is related, " a very noisy tone prevailed throughout the school," and one reads of " refractory girls evidently awed into obedience." Gradually, we learn, " the boys are taking more interest in their work and the tone of the school is raised."

At first no great attention was paid to the health of the children, though free breakfasts and dinners were supplied in times of stress. Then it began to be realised that health did enter into education ; delicate and weakly children, it was seen, did not make due progress in their lessons. A visitor to the school would probably see only a class of more or less ordinary children, but the teacher who had to deal with them day after

day quickly found that he was up against a different proposition. What of this child who was continually absent from sickness or that one who was apparently very dull or very deaf?

Then came the school medical officer on the scene—not without some protest. Like every specialist, the educationist is somewhat suspicious of others who may interfere with his particular sphere of action. Then again, it was thought that this was an undue meddling with parental rights and responsibilities—but what parent thinks so at the present time? Slowly but surely the school doctor has found a footing in the life of the school, and few can deny that the result has been, and is increasingly becoming, of the utmost benefit to the health and education of the child.

Health Inspection.

Let us see if we can find any improvement in the health of the children as compared with those early days. The first group photograph, taken some thirty or forty years ago, is from a school in a somewhat poor neighbourhood. The photograph shows the children of Standard VI., rather small and thin. There are no smiles on their faces. Perhaps they have not got quite accustomed to the idea of "compulsory" education, and evidently take no joy in it.

In the second photograph (Standard V.) from the same school, taken two or three years ago, the children look fatter and better cared for and are smiling and happy.

It can be said in all truth that the school child nowadays is rather pleased to be at school. He has not lost his zest for play, but he no longer feels his school a sort of prison. One great reason for this is that the spirit of games is carried into the life of the school. Games are actually encouraged there. In the old log-book we read further that a request was made for football to be treated as a part of physical exercises. But a stern committee said: "No, you must have your drill. Football is inexpedient as a physical exercise." A strange contrast to the time-table of to-day, when all sorts of games take the place of the old drill instruction. It may be interesting to compare the average attendance made by scholars over a number of years. These figures and the other facts mentioned in this account are taken from a typical English county borough and are probably similar to those of like towns:—

	Average attendance		Average attendance
1872—1877 ..	73.4	1898—1907 ..	86.0
1878—1887 ..	77.5	1908—1917 ..	87.3
1888—1897 ..	83.1	1918—1927 ..	88.0

Courtesy] [J. Maxwell Taylor, M.B.

FORTY YEARS AGO: STANDARD VI.

Surely this is a record that argues a general improvement in health?

Change in physique is another factor that might be taken as showing an improvement or the reverse. General observation is not of much real value from this point of view, though a comparison of the two groups

shown in the photographs would appear to indicate an improvement, especially when one considers that the recent photograph is of a lower standard than the older one. And if the opinion of teachers of long experience is consulted they invariably tell you that the improvement is very pronounced. It is only from careful weighing and measurement of large groups of children over a number of years that we can draw any useful deduction.

Courtesy] [J. Maxwell Taylor, M B

THE SAME SCHOOL TO-DAY STANDARD V.

Unfortunately, we have no records of the early years. Reports from practically the whole country show that within the last few years there has been a gain both in height and weight. This is most clearly seen in the case of the older girls and may confidently be attributed to their greater participation in outdoor life and in games in general. An interesting corroboration of this fact is seen in the difficulty which Education Authorities have in providing desks for these young Amazons. Desks which were quite large enough some years ago are now found to be several sizes too small.

Another factor pointing in the same direction is the much greater attention paid to cleanliness, both of person and clothing. If there were no other improvement to be shown than that of personal cleanliness the effort would still be worth while, for cleanliness is the foundation stone of health. No one who has seen the remarkable effect on the children in health and in enjoyment of life caused by the introduction of school baths can doubt this. And, of course, school baths are only a makeshift for the bathroom at home and the means of teaching its use. It is common knowledge that some people make odd uses of their bath; such, for instance, as storing coals in it. The other day, a small boy was remonstrated with for being very dirty and replied that he had been unable to have a bath for some time on account of the canary. It transpired that his father who had recently gone into a new house in which there was a bathroom—a hitherto unaccustomed luxury for them—was a keen canary breeder. As the birds were nesting and not to be disturbed they were put into the quietest corner of the house—the bathroom. Hence the dirty boy.

Great progress is also being made in school dentistry, and the many thousands of children who come under the hands of the school dentists every year form yet another testimony to advancement in health methods.

The treatment of skin disease and of minor ailments, and operations for unhealthy tonsils and adenoids are all lending their influence in the right direction.

But, when all is said and done, much still remains. Medical inspection and treatment are, at best, slow in their action. It would be no over-statement to say that 20 per cent. of the children are still appreciably underweight—due, in the main, to faulty habits of living. Our efforts must be redoubled on behalf of the children. There must be more

open-air teaching. There must be greater efforts to inculcate the doctrine of cleanliness. There must be more systematic teaching of the simple laws of health, which means that there must be still closer co-operation between the teacher, the physical instructor, and the school doctor.

THE TEACHING OF HYGIENE

By E. S. SEMMENS, B.Sc. (Lond.).

IT has been my task to re-organise the whole of the science work in several High Schools, and also in some Secondary Schools for girls, and in each case I was given an entirely free hand.

In many, the time allotted to science, short as it was, was terribly wasted. Girls had spent hours on botany, determining the composition of a fibro-vascular bundle, or, in those which boasted of more modern methods, in measuring the exact volume of a cone or of a cylinder. The latter asked, with long faces, at the first lesson : " Must we do any more physical measurements ? They are so dull." Science was unpopular, and was always the first subject to be dropped when " cramming " for an examination. Even in those schools where there were good laboratories for physics and chemistry, sensible and old-fashioned parents would ask : " What is the use of this for girls ? "

It seemed, therefore, better to begin on an entirely new plan. Instead of copying the work of boys' schools, we would first ask ourselves : " What is the study of science to do for the education of our girls ? " Some one has said : " Science is for truth, for nobility and for usefulness." None of these three aims must be forgotten. Science must teach the child to think truly and clearly and to have wide ideas of wonders of Nature, but, besides this, it must help to fit the child for life.

Science in the Home.

Now, of all sciences, hygiene, with all that it should imply of scientific training in chemistry, physics, biology, is best fitted for the latter purpose, especially in the case of a girl. We want girls healthy in body and in mind, able to think clearly and truly, and capable of spreading health and happiness around them, above all in their homes.

While the boy naturally loves to apply his scientific knowledge to machinery and engineering, the science for the girl should be that of home life. The cure of a smoking chimney may afford an excellent example of the laws of heat, and chemistry can be well applied in the laundry. In fact, all domestic life is, to a great extent, applied chemistry and physics.

Hygiene may be taught in four ways. We may have the practical and imitative methods of the kindergarten—the observation or nature study method—we may weave it into the ordinary course of physics, chemistry and biology—or we may have the experimental and scientific method. Which of these shall we use ? I would reply, " All of them."

Now, I believe that we cannot begin too early to instil into the child those ideas and habits which make for healthy life. The most valuable of all hygiene lessons may be given in the kindergarten and first forms.

Here the doll may become a most educational factor. It has been said that the modern child does not care for dolls, and children of seven are known to prefer a fountain pen or a scent bottle for a present. But at Canterbury we commenced with the doll. Its toilet, bath, nursery, and a hygienic and home-made doll's house, occupy the first two winter courses.

The children greatly enjoy these lessons, and we divide the science teaching into winter and summer courses, because in the winter the children's thoughts naturally turn to their homes, while in the summer they are more interested in their gardens and out-of-door life.

From this stage we pass to the study of plants and animals, and the conditions of their life. The interdependence of plants and animals, illustrated by an aquarium—the various methods of breathing and feeding of animals—the action of green plants—the making and storing of food by plants, etc., will all form a basis for future direct hygiene teaching.

This course of botany and nature study

occupies two years. Then, in the middle part of the school, we have another short course of hygiene, consisting of simple talks on fresh air, sunlight, wholesome food and cleanliness.

The teaching must necessarily be somewhat dogmatic, although illustrated by many simple experiments. The path of physiological discovery can certainly not be trodden by the child. If we can only make them realise that dirt, damp and darkness breed disease, and that sunlight, fresh air and soap and water bring health, we shall have achieved something.

The hygiene of the class room is to keep it clean and well ventilated. For this it is necessary that the children should have before them the object lesson of an absolutely clean and hygienic school building. One evening in the East End I was telling the children how much nicer it would be to come with well washed hands and pinafores. "Teacher," called out one small child, "shall we wash all these?" She pointed to the filthy walls and staircase of the day school in which the classes were held.

Special stress is laid on the correlation of these lessons in hygiene with their other subjects. Children love to aid this, and will often make ludicrous attempts in this direction. At a chemistry lesson I once mentioned the fact that the sodium we were using was kept in naphtha. "Oh, yes," said one little girl, with a smile of delight, "we learnt all about that in the Latin lesson this morning. It is what the gods used to drink!"

Special reference can be made to the lessons in botany. For instance, we pull up a bean and find the tubercles on the roots, or we put away some jam, or other food, in a damp dark place and find it grows mouldy, and then we talk about the good germ-fairies who help to feed the bean, and whose presence makes the butter and cheese, as in the old fairy stories, and the wicked germ-fairies who bring disease and who hate the sunlight and fresh air.

[Keystone

TRAINING FOR MOTHERHOOD

A lesson in the care of children at a school for household duties in Berlin.

Courtesy.] [C. A. Bang

A LESSON IN FOOD VALUES

Children at practical work in a Montessori school.

will not pay in the examination! The Oxford Locals have dropped it from their syllabus, and from the Preliminary or King's Scholarships Examination for Pupil Teachers it is absolutely excluded.

The intending pupil teacher may study the structure of the stem of a dicotyledon or the life history of a frog, but it is considered superflous to learn anything about the life of a child. Could not some alternative syllabus for girls be added to many of our public examinations, other than the botany, which has, as Besant says "always been considered the proper subject for girls?"

In conclusion, I would urge the necessity that every girl should have definite lessons on the care of children. I do not believe in introducing purely technical subjects into the school curriculum, but this is of such vital importance to the nation. A matron of a crèche told me that she felt sure that 90 per cent. of the infant mortality was due to the ignorance of the mothers. Here experience is not the best teacher in one sense, for we cannot afford to experiment at the cost of the suffering and death of the children.

Lessons in Child Welfare.

Every woman will not require a knowledge of higher mathematics, or even such subjects as physical geography, etc., but every woman worthy of the name will at some time of her life have little children or aged people under her care.

I would have a crèche in connection with every school, where the girls should learn practically the care of children under an experienced nurse, and where lectures could be given on the subject. The love of little children is instinct in every true-hearted girl, and there is no greater womanly charm than that acquired by constant dealing with them.

About the age 12-13 the children begin a thorough course of heuristic training in physics and chemistry, applying it as much as possible to common life. The necessity for this training, which should occupy at least three years, cannot be too strongly insisted upon. Physiology without its true foundation of physics, chemistry and biology is a baseless fabric and absolutely unintelligible; therefore the lessons in hygiene and physiology should be given by the teacher of science, but in co-operation with the teacher of gymnastics and under the guidance of the school doctor.

We now come to the upper classes, and here at least half the time allotted to science should be occupied by a course of simple lessons in physiology, the chemistry of food, and, above all, the care of children. Valuable lessons can be given on the necessity of reverence in approaching the subject, and one must be careful to guard against morbid feelings on the part of nervous girls, with regard to their own health. The best antidote to this is to emphasise the point of view of care for the health of others, such as children and aged people.

In the upper classes—alas!—we come to that area of school life troubled by the Public Examination. The welfare of the girl and of the nation demands teaching in health, but it

THE VETERINARY PROFESSION AND PUBLIC HEALTH

By Professor FREDERICK HOBDAY, C.M.G., F.R.C.V.S., F.R.S.E., Hon. Veterinary Surgeon to H.M. the King.

THE general public as a body has no conception of the part played by the members of the veterinary profession in the preservation of public health, nor has it the slightest idea that the absolute freedom in Great Britain from such diseases as glanders and rabies, to mention only two of the most terrible of the diseases which are infectious from animal to man, is entirely due to the efficient administration and control exercised by the Veterinary Department of the Ministry of Agriculture and Fisheries.

Other diseases, such as anthrax and foot-and-mouth disease, although occurring at spasmodic intervals, would be a menace to man if they were allowed to spread without control amongst the animals of this country. Tuberculosis, which is such a scourge among human beings, is equally prevalent among dairy cows; whilst minor diseases, such as mange of the dog and horse, are readily contagious to human beings, and would give rise, if unchecked, to a great deal of discomfort, apart from any question of economic loss.

The above mentioned are only a few of the diseases for the prevention of which it is necessary, in the interests of the public health, for the medical man to seek the aid of his veterinary *confrère*; and it is worth our while to consider these ailments for a few moments in detail.

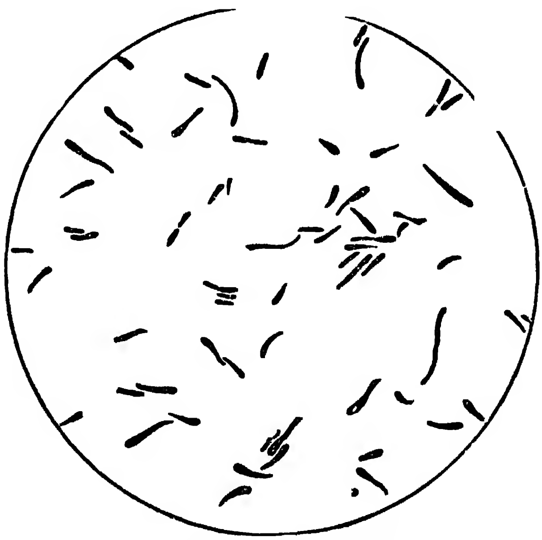
Glanders and rabies are two of the most horrible diseases which can attack either man or animal, and they each come to man originally only through the medium of the animal.

Glanders.

Glanders is primarily a disease of the horse tribe, and affects horses, asses and mules, equally. Its cause is a small organism, known as the *Bacillus mallei* on account of its peculiar hammer shape, and when it gains entrance to the system, either of man or animal, it will cause the most terrible illness that it is possible to imagine, practically always terminating fatally, and being accompanied in the later stages by great pain and ulcerative sores in various parts of the body. It is an extremely dangerous organism to work with in the laboratory.

It is a disease which is most commonly met with amongst stable workers and those who come in contact with horses; and some twenty years ago grooms and stablemen of studs in our big cities all knew its name. A man can be readily infected by the discharge from the nostrils of an infected horse, or even by handling the brushes, sponges, or stable-cloths which have been in contact with a glandered horse. London alone was responsible for an average of nearly 2000 deaths a year amongst its horses in the London County Council area; whilst Glasgow, Liverpool, Birmingham and certain other large towns in England were also badly infected.

In the South African war it was accountable for the deaths of many thousands of our army horses; and, indeed, in all wars it has been the bugbear for which the Army



THE CAUSE OF GLANDERS
The bacillus mallei, which causes a dangerous disease in horses—transmissible to man.

Veterinary Officer is always on the lookout. In addition to their being a danger to man, horses suffering from this complaint are unable to do their work properly, and it is so insidious that until it has been present in the system for a certain length of time its presence may remain unsuspected.

Modern veterinary science has now, however, at its command, a method by which its detection can be made certain, as, by the introduction of a few drops of a special preparation of the organism itself, the skilled veterinarian can tell with certainty within forty-eight hours, even if the animal is infected only in the slightest degree. During the great European war, by means of this test, applied by the officers of the Royal Army Veterinary Corps, glanders was entirely eradicated from the horses and mules of the British Army ; and it has been applied so successfully in Great Britain that at the present time it has absolutely ceased to exist. This means that now that it has been eliminated from the list of diseases which the veterinary surgeon is called upon to diagnose in animals, it has also been eliminated from the list of diseases which his medical *confrère* is called upon to diagnose in man.

So long as the present regulations of the Veterinary Department of the Ministry of Agriculture are kept in operation, so long will man in this country be unassailed by glanders.

Courtesy, "Manual of Bacteriology" Hewlett (J. & A. Churchill)

A HORSE WITH GLANDERS

Showing the ulcerative sores or "farcy buds" typical of the later stages of the disease

Rabies. Rabies has not been met with in man in England for more than thirty years ; and it can never appear again as an epidemic in this country so long as control is kept upon the importation of dogs and animals of the dog tribe. The primary cause of rabies in man is the contact of an abraded surface of the body with the saliva of a rabid animal, and whether the rabid animal is a horse, or a cat, or any other animal, it has always had its origin from a rabid dog. The Muzzling Order imposed by Mr. Walter Long as Minister of Agriculture a number of years ago succeeded, after a period of some months' continuous operation, in eradicating the disease amongst the dogs of Great Britain, and it then remained for the veterinary advisors of the Ministry of Agriculture to take steps to see that it was not reintroduced into the country—a second proof of the value of the collaboration between the forces of the veterinarian and the medical man in the cause of public health.

Anthrax. Anthrax and Foot-and-Mouth Disease are ailments which particularly affect cattle, but both are contagious to man. Anthrax is always serious, as, if not taken in time, it invariably results in death. In cattle, death is very sudden, and the Government has imposed laws and regulations which provide that the body must be cremated as near as possible to the place where the animal died. It is forbidden, too, in any way to cut the carcase, as on many occasions those making, or assisting at, the *post-mortem*, have become infected and have died in consequence. In Bradford and other districts where wool from foreign countries is handled, disinfection is compulsorily adopted with satisfactory results ; and if such practice could also be adopted in the case of hides, bone-manure, and other animal products before they are imported into this country, deaths from anthrax in man and animal would diminish considerably.

Foot-and-Mouth Disease, so much to the fore at the present time, has, in the daily Press, provoked a good deal of adverse, stupid and ignorant criticism against the

[Sport & General

A PRECAUTION AGAINST FOOT AND MOUTH DISEASE
Dipping the boots in disinfectant before inspecting stock in an infected area.

Veterinary Advisers to the Ministry of Agriculture; however, there is no question but that they have adhered to the correct policy, which is that of "stamping out," although the cost of the outbreaks which have occurred since the war has amounted to between one and two millions of pounds. Yet we have much to congratulate ourselves upon when we compare our position with that of other European countries. The cost to Holland, France, Belgium, Denmark and Germany, is almost as much as that each year, and they never get any further forward, having the disease always endemic. The public has only to think what it would mean to England if the disease were allowed to spread, with the fact before it that milk from cattle affected with foot-and-mouth disease must not on any account be consumed by children or invalids, nor be given to goats, pigs, or any other animal.

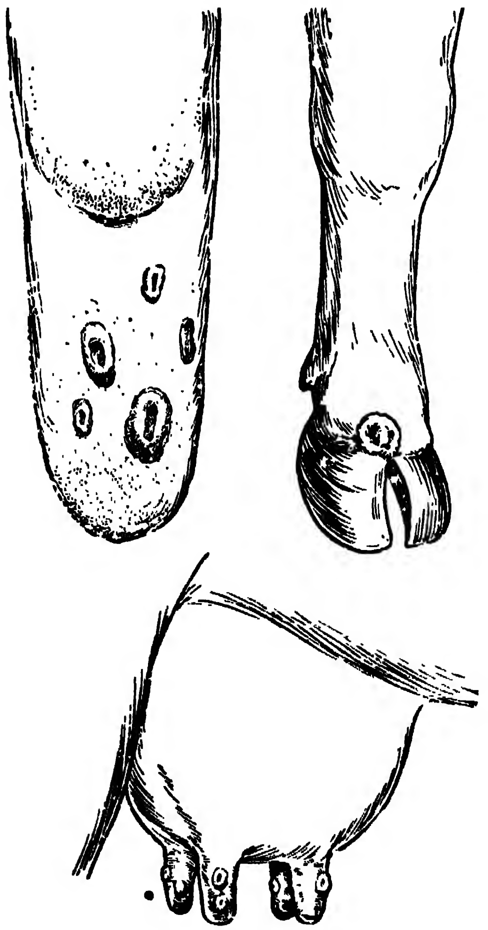
Foot-and-Mouth Disease.

Tuberculosis is pre-eminently a disease to illustrate the value of collaboration between the medical man and the veterinarian. *Every Medical Officer of Health knows full well the danger of tuberculous milk, and it is necessary that the public should be acquainted with this too.* It has been estimated by the Medical Officer of Health for London that out of fifty consecutive samples of milk which had been purchased in the city, not less than one in four proved to be tuberculous; and the Statistical Assessor in Ireland estimated that 6 per cent. of the deaths from tuberculosis were due to drinking tuberculous milk.

Tuberculosis.

At one of the national milk conferences, Dr. Stanley Griffiths, in a paper on "Bovine Tuberculosis and its Relation to Man," gave statistics which proved more than ever the necessity for the human and veterinary branches of medicine to pull together. At an investigation of 1200 cases of tuberculosis, he

found that 87.5 per cent. of infections with tuberculosis of the neck glands in children up to five years of age were bovine, and, similarly, 61.3 per cent. of those between five years and ten years, 37.9 per cent. of those between ten years and sixteen years, and 25 per cent. of those of sixteen years and over. Of 476 cases of bone and joint tuberculosis 28.7 per cent. of those under five years were of bovine origin, 23.1 per cent. of those between five and ten years, 9.5 per cent. of those between ten years and sixteen years, and 6.4 per cent. of those of sixteen year and over. Of 126 cases of lupus, 69 per cent. of those under five years, 42.5 per cent. of those between five years and ten years, 60 per cent. of those between ten years and sixteen years, and 17.6 per cent. of those of sixteen years and over were of bovine origin.



THE SIGNS OF FOOT AND MOUTH DISEASE

Blisters filled with fluid form on the tongue, the teats and between the claws of the feet.

Similar percentages were found in connection with certain other diseases, and of 113 *post mortem* examinations conducted by the Local Government Board, it was found that in 21.3 per cent. of those under five years at death, the infective organism was bovine, and, similarly, in 13.4 per cent. of deaths between five years and twelve years. The same medical scientist estimates that tuberculosis contracted through the consumption of cow's milk causes approximately 3000 deaths every year; and as all these infections are made in the drinking of milk from cows suffering from tuberculosis of the milk glands, it is hoped that now that the regulations are in operation which compel the owner of a cow having anything wrong with the udder to call in a veterinary surgeon, they will have the effect of eliminating in a great measure the chances of infection from the cow to man. *The diagnosis of tuberculosis in the cow can only be made accurately by the trained veterinarian, and his value in relation to the public health is again here demonstrated.*

Mange.

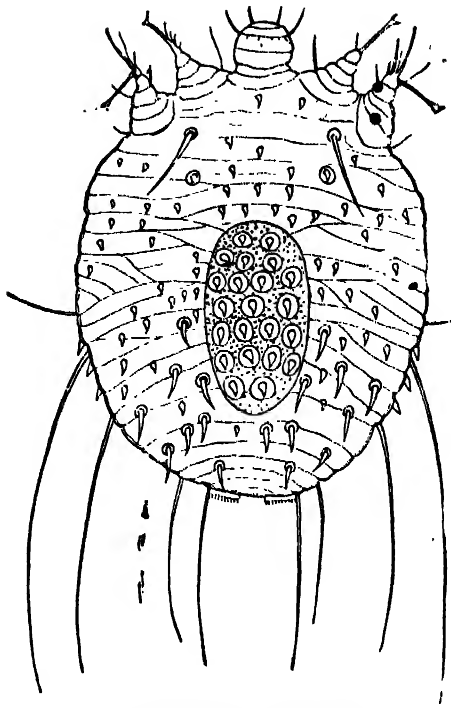
Mange of the horse is now dealt with in all parts of Great Britain under a Mange Order issued from the Ministry of Agriculture, and its spread has now been effectually checked, although not yet completely eradicated; but the number of cases of mange in the horse is now extraordinarily small; the average for the second week in the month of July for the whole of Great Britain being only seven outbreaks and thirteen animals attacked. It is, however, to the domestic pets, especially the dog and cat, that the attention of the public should be drawn, *for it is quite an easy matter for a pet dog to transmit the parasite of mange from itself to its owner.*

An itchy dog should, therefore, always be regarded with suspicion, and the pernicious habit of allowing a dog to sleep in bed in company with a human being should be very emphatically discouraged. A dog with mange, especially in hot weather, or when its body becomes heated by lying in front of the fire (or sleeping on an eiderdown or

blanket), will be continually scratching, especially in the region of the armpits and under the thighs, where the body is hot and the hair is thin. If no treatment is adopted the dog will break out in sores and the hair will fall off; and the animal presently becomes very offensive in smell and covered with scabs. *If allowed to come in contact with any part of the human body for more than a few minutes it is quite an easy matter for the parasite to transfer itself to its human host;* and it may remain there for quite a considerable number of days or even weeks until it has finished its life history.

There are numbers of other diseases in which it is of value to the Public Health Service that, in the fight for their eradication, the human physician and the veterinarian should collaborate, for the patients of each are equally attacked. Cancer can be taken as a type, for this dreaded disease is recognised in horses, cattle, dogs, cats, and even in fish; and many of the theories which research workers form, if their observations are concentrated on man alone, can at once be seen to be erroneous upon comparing notes with veterinary pathologists, whose lives bring them in daily contact with the comparative aspect as seen in the naturally infected animal.

Foreign countries have for a long time recognised that, and their respective governments have granted liberal funds for research into the problems of animal diseases and their relation to the public health. Great Britain, as usual, has been very much behindhand in this respect, although, during the past few years, by the establishment of an Animal Research Institute connected with the Royal Veterinary College at Camden Town, the Institute of Animal Pathology at Cambridge, and the Diseases of Animals' Research Association in Edinburgh; together with the establishment of university veterinary degrees and the post-graduate diploma of Veterinary State Medicine by the Council of the Royal College of Veterinary Surgeons, there is a good prospect that before another decade has passed a government organisation of veterinary officers of health will be accorded an important place in public health.



THE PARASITE OF MANGE
One of the parasites which cause mange in the dog. (Highly magnified.)

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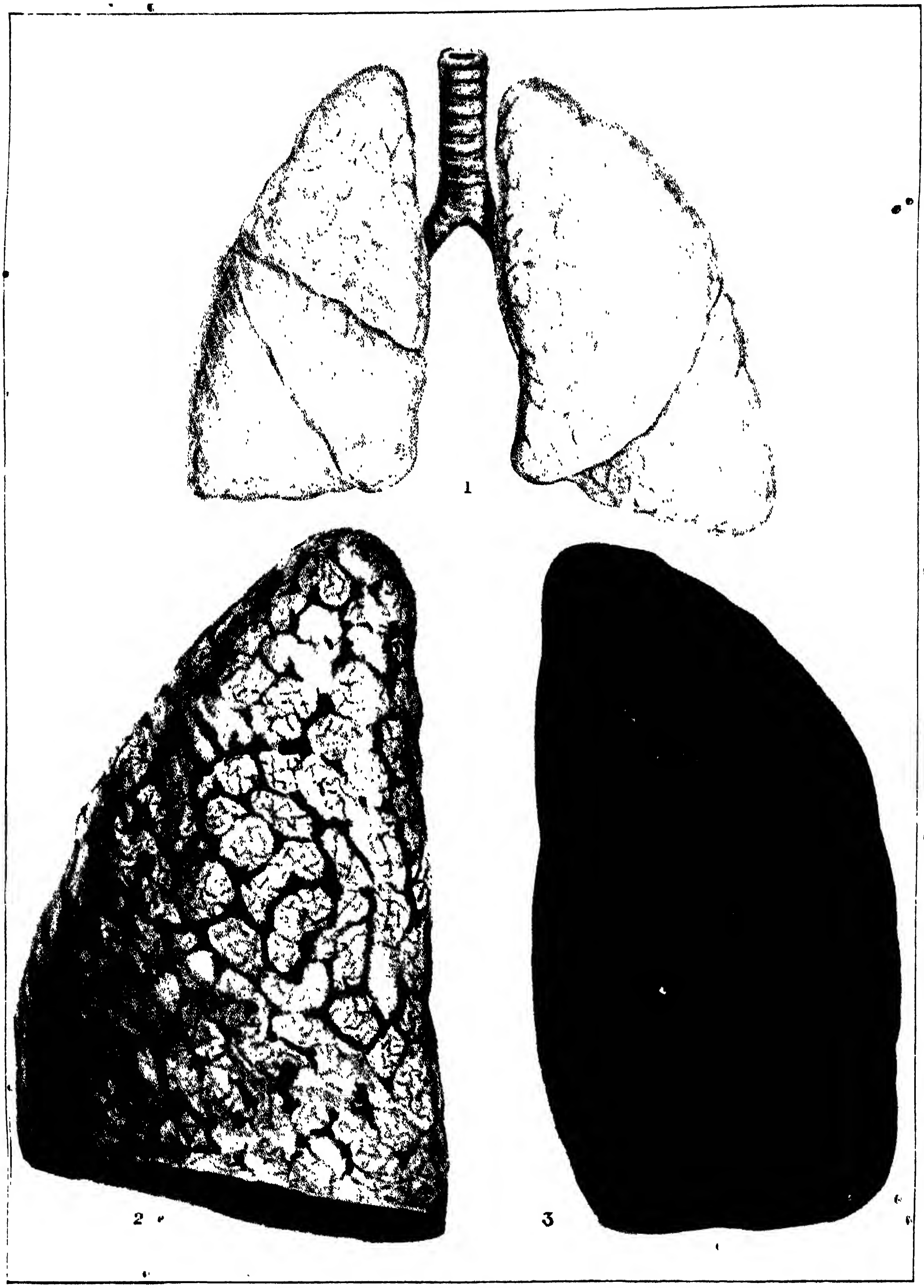


THE EFFECT OF DUST ON THE LUNGS.

Drawings taken from actual specimens, showing the lungs of—(1) An infant. (2) An adult town dweller. (3) A coal miner.

XXV

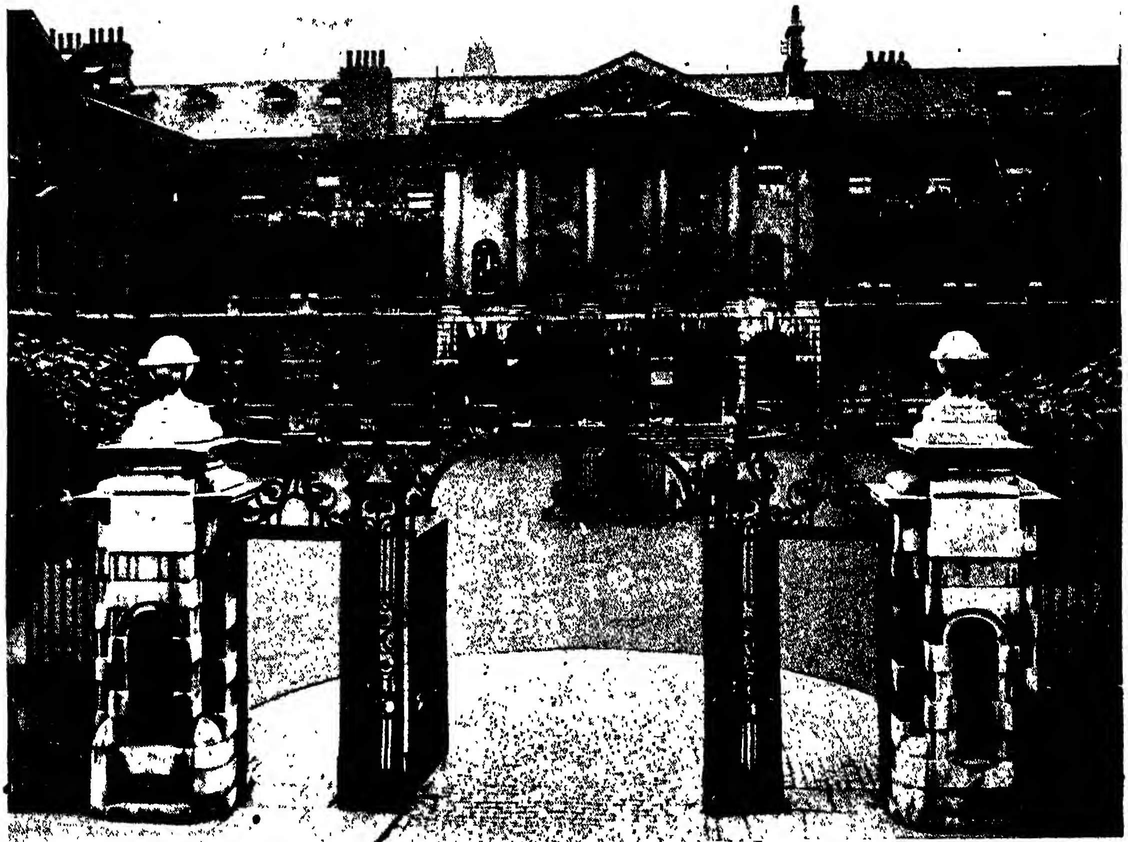
HEALTH IN INDUSTRY:

THE ECONOMIC CONSEQUENCES OF ILL-HEALTH

By MEREDITH ATKINSON, M.A., late Professor of Economics in the University of Melbourne and Lecturer in Economics and Politics to the Cambridge University Board of Extra-Mural Studies.

FOR many centuries the history of nations was the history of kings and their wars. It was a military and political history. Only recently the importance of the economic factor upon the fate of nations was realised and learned men concentrated their attention upon the economic interpretation of history. The dawn of the health age is approaching, and historians, social students, politicians and writers will do well to investigate and describe the effects of ill-health and hygiene upon the body economic, and the body politic.

The importance of the health factor upon the prosperity, the happiness and the greatness of nations can scarcely be overstated. Many causes brought about the decline and decay of the great empires and of the great civilisations of the past. Among these, disease and ill-health were of the very greatest importance. Sparta defeated Athens at the end



[D. McLeish

GUY'S HOSPITAL, LONDON

This hospital, which was founded in 1721, has 643 beds and a yearly income of over £100,000.

of the Peloponesian war because the strength of Athens was destroyed by the plague described by Thucydides. Greece might have survived internecine warfare had not the strength of the people been sapped by malaria. Apparently the malaria-carrying mosquito was brought to Greece in the course of the trade carried on by that country. The boundless energy of the nation became crippled by widespread ill-health, and the genius of that glorious people disappeared, together with its virile strength.

The Italian peasantry were the backbone of the Roman Empire. Italy, like Greece, was apparently free from malaria, or nearly free, during the time of Rome's greatness. Then the malaria mosquito made its appearance, and the spread of that disease, described by Roman writers, led to the abandonment of the countryside, to the disappearance of the peasantry, to the physical decline of the race, to the loss of those manly qualities which had made the Italian agriculturists the masters of the world, and to the overthrow of the world empire by healthy barbarians.

...her states and empires have gone down ...ar manner through similar causes. ...ation, as to the individual, health ...ngth are the most precious posses-

...political and the economic conse-...ts of ill-health are far-reaching. A veritable army of doctors, nurses, chemists and scientists of every kind are engaged in the struggle ... disease. The medical army of every ...ntry is more expensive than its military ...ce. Ill-health is therefore a greater direct ...rden upon the nations than that militarism ... which we hear so much.

...of ...lth.

The invisible damage is very frequently vastly greater than the visible damage. This applies particularly to matters of health. A great many people do not complain about actual ill-health necessitating skilled professional advice. However, they complain about never feeling "up to the mark" or rarely feeling "up to the mark." Reduced health is vastly more costly to the nation and to the individual than are diseases with a name.

A man in perfect health can walk twenty or thirty miles a day without feeling tired. He can carry heavy burdens without exertion and without damage. He can expose himself to severe weather without hurt. He can perform intellectual work rapidly and excellently. A man in reduced health will find that a walk of a mile or two exhausts him, that moderate physical work is beyond his strength, that exposure to a change of temperature makes him ill, that he cannot concentrate his thoughts, etc. Men in reduced health work without zest. They are crippled physically and mentally. Their work satisfies neither them nor those for whom they work. Efficiency and good health go together and inefficiency and reduced health go hand in hand.

Efficiency and Health.

Reduced health is disastrous both to the leaders of the economic army and to the rank and file. Business men and managers are unable to make up their minds, and make wrong decisions because reduced health prevents their seeing clearly, and millions of workers work slowly because their energy has been lamed by slight but more or less chronic ill-health and physical discomfort. In a damp and somewhat depressing atmosphere, such as that of this country, energetic work can be performed only by people who are in buoyant good health.

Economic success in the modern world depends to a very large extent upon cordial co-operation between the employers and the employed. Social dissatisfaction and friction between employers and employed were never greater in this country than they are at present. At the same time we find that although the death-rate has been steadily declining, ill-health and reduced health have never been more in evidence than they are now. That may be seen by the sale and the advertisements of patent medicines which have perhaps become more indispensable to the majority of people than certain essential foodstuffs. Ill-health and reduced health

From the Painting] [By Van Ostrade

"THE WEAVER'S REST"

Before the rise of the modern factory system—a weaver's hand loom set up in his own home.

embitter men's minds. Digestive troubles are responsible for depression, melancholy, despair and insanity in innumerable cases. Reduced health and actual ill-health are largely at the bottom of social dissatisfaction and labour troubles, and this is only natural. As the Latin proverb tells us: "A sound body and a sound mind go together." Cheerfulness cannot be expected among chronic dyspeptics.

The economic consequences of ill-health are absolutely incalculable. Health, happiness, prosperity and power go hand-in-hand. Ill-health creates unhappiness, poverty and despair, and not a few revolutions and wars have been caused by it.

INDUSTRIAL DISEASES: THEIR CAUSES, PREVENTION AND CURE

By SIR THOMAS OLIVER, M.A., M.D., C.M., F.R.C.P., Emeritus Professor of Practice of Medicine, University of Durham and College of Medicine, Newcastle-upon-Tyne.

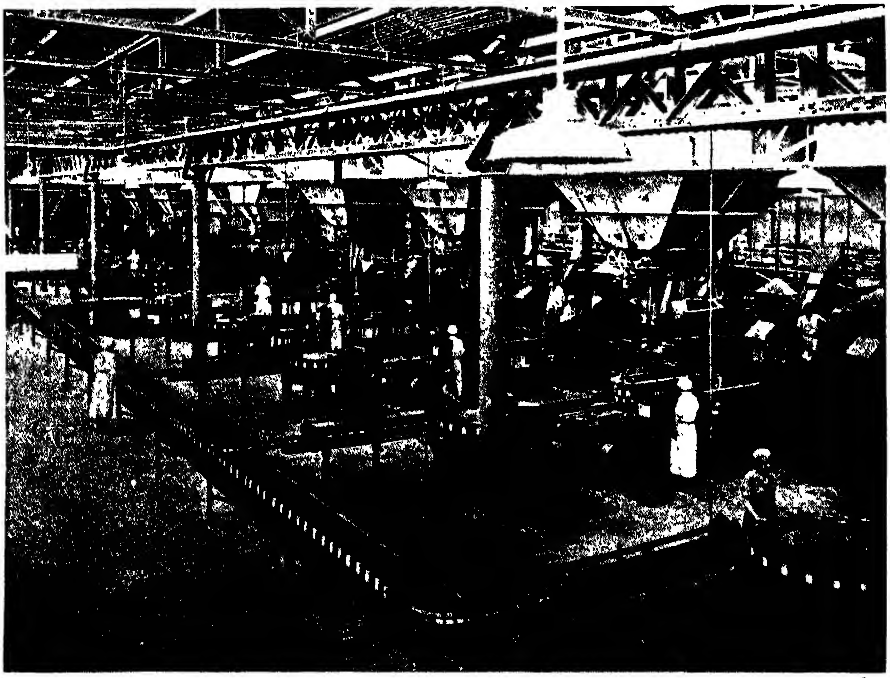
OCCUPATION IN ITS HUMAN RELATIONS

FROM an industrial point of view there is no more interesting period in the history of our island than that which saw the rise of the modern factory system. In the immediately preceding centuries Great Britain had been mainly an agricultural, wool-growing and cloth-making country, but the replacement of water-power by steam and the introduction of machinery made possible new sources of energy, the utilisation of which was followed by social and economic changes, the effects of which

remain with us until to-day. The period referred to is known as the "Industrial Revolution." It began about 1760; by 1840 its activities were on the wane. There is a belief that until the introduction of steam-power there was no factory system in this country. This is hardly correct. Factories existed before the inventions of Hargreaves and Arkwright became operative in the textile industries. It took more than a century for the factory with its machinery to displace home craftsmen. The process of displacement was slow but it finally succeeded. The Industrial Revolution was followed by considerable social disruption. Although in the main making for cheaper and greater production, it was neither at its inception, nor has it been since, an unqualified benefit and source of contentment to the working classes. Machinery, by lightening labour, enabled women's and children's employment to supplant that of men.

It is unnecessary to dwell at length upon the unhappy state of affairs which prevailed in the first seventy years following the Industrial Revolution, with its attendant drawbacks, the rush of people from the rural districts into the towns, thereby creating overcrowding and the breeding of an enfeebled race, to say nothing of the hardships imposed upon women and upon children robbed of childhood's rights. Waterloo won in the second decade of the nineteenth century had left, like all war, an aftermath of additional poverty and had aggravated unemployment. The present eight hours' working day is a boon to toilers in mine, factory and workshop, and compares most favourably with the twelve and thirteen hours per day for women and children in the early part of last century. However repellent may have been the long hours and the inhuman treatment of children in the mines and factories, it is a satisfaction to know that while it was in Great Britain that the modern factory system originated, so was it in this country that the earliest attempts were made to redeem the factory worker and make his occupation more tolerable. These only became possible through parliamentary legislators, whose primary efforts were directed to shortening the hours of labour, to securing for the workers a more adequate return for services rendered, and to reducing in a general manner the risks to life and health.

Industrial Revolution.



Courtesy] [Lever Bros. Ltd.

IN A MODERN FACTORY

Showing the intricate machinery and labour-saving devices which have largely replaced hand labour.

The movement thus established was to a large extent the outcome of an appeal by Dr. Percival, of Manchester, who in 1796 suggested factory legislation

Photopress, Ltd

A TYPICAL MANUFACTURING TOWN

An aerial view of Preston with its factories and rows of workers' houses—a striking illustration of the overcrowding which has followed the Industrial Revolution. Contrast the modern garden city, shown on page 1489.

to end, if possible, the human tragedies he had witnessed in his daily rounds. Ramazzini, an Italian physician, had a few years previously published a book on the effect of certain occupations upon the health of those concerned. There had thus dawned, medically speaking, a new industrial epoch, but although legislation had dealt in a fragmentary manner with long hours and the excessive employment of women and children, the actual conditions inside factories and the dangers incidental to industrial occupations, apart from coal mining, had received but scanty consideration. About 1830, Thackrah wrote upon diseases of occupation. Half a century afterwards Arlidge, of Stoke-upon-Trent, drew attention to the maladies of the Staffordshire potters, and Hall, of Sheffield, had written upon the pulmonary diseases met with in persons employed in the manufacture of cutlery.

It was in the nineties of last century that the high mortality rates in certain occupations attracted the attention of the Government, and the Home Secretary, then Mr. Asquith (later Lord Oxford), appointed departmental committees to inquire into the health conditions in the manufacture of high explosives, the manufacture of white lead and the use of lead compounds, also the manufacture of lucifer matches, etc. This was a novel adventure on the part of the Government, for it sought to utilise temporarily the assistance of medical men outside the realm of the Factory Department of the Home Office. Since then the influence of occupation upon the health of the workers has received more attention, so that, concurrently with the progress of the Public Health movement, a new branch of medicine has evolved, viz., Industrial Hygiene, the importance of which was recognised a few years ago by the Government appointing a Medical Research Committee.

Industrial Hygiene.

It is impossible to speak too highly of the value of the work accomplished by this committee, or of the assistance it has rendered to the Home Office; a similar remark applies to the work done by the National Institute of Industrial Psychology. Methods of industrial production keep changing, and they progress with the years; in the laboratories, chemists are unceasingly wringing from nature concealed treasures, and by synthetic means are evolving new compounds which have not only simplified production but given rise to new industries. We never quite know until new compounds have been tried what will be the effect of these chemical combinations upon the health of workers brought into close contact with them. "Industrial Medicine" has to keep pace with chemical discovery,

with physical science as applied to deep mining, iron shipbuilding, tunnelling for railway and civic purposes, also with the use of compressed air in caissons for securing safe foundations for the piers of stupendous iron bridges.

The ingenuity of man keeps bending science to the needs of the race, and is making industrial enterprise more and more complicated. More than a century and a half have passed since steam replaced water-power and machinery began to displace handcraft. In electricity a rival to steam has arisen, the possibilities of which are far-reaching. Its use as an illuminant and motive power for transport is increasingly in demand. Greater utilisation of high tension energy in our industries would make for further efficiency, and would help to resuscitate and expand those industries which have been declining.

Although machinery, wherever and whenever introduced, displaces hand labour, so that fewer workers are required, it ultimately tends in many instances to give employment to larger numbers. Machine work has come to stay. There can be no return to the types of hand labour of a century ago. The tendency is rather in the other direction, as also to the greater use of labour-saving devices. "Machinery is an amplifier of man's muscular power, to which is added precision conferred upon its mechanism by the skill of the inventor."* One of the drawbacks to its use is that it makes work monotonous, and when to this is added the subdivision of labour giving rise to "repeat" work there is apt to occur, when "repeat" work is followed closely for a lengthened period, what for the moment may be called a "nervous breakdown" on the part of the operative, obliging him to ask for a change of employment.

Health problems therefore arise out of the increasing tendency to use high grade machinery, not on account of this requiring more muscular effort to direct it, but because of the nervous tension it creates in the individual. Machinery does not give to those who mind it the opportunity of an enlarging area, and of variation, for the application of their intelligence. To that extent therefore it is cramping, and yet there are many instances of men as machine-minders who by detecting defects have improved the producing power of machinery and enriched themselves thereby. It used to be thought impossible to make machinery capable of replacing human skill, for example in glass-making, and yet nearly all forms of glass ware at present in use have thus been made, and so great is its efficiency that the machine produces forty-one times more material than by the old hand process. Skilled glass blowers have in consequence ceased, or are ceasing, to be employed in the industry, since one man becomes capable of doing the work of forty-one men.

James T. Davis, Secretary of Labour to the United States, has revived the question "What is machinery doing for us, and what is it doing to us?"* It may with certainty be said that it has added to the amenities of life; by producing goods more cheaply and in larger quantity it has given employment to larger numbers of persons, and while its immediate effect is a reduction in wages, ultimately by increased output it raises them. Formerly, where heavy loads were carried by labourers, these are now transported in many instances by machinery. In the heavy industries this is particularly the case. By recently introduced sheet-rolling processes in steel plate manufacture, six times the quantity of material is produced. This means that men have unfortunately to be dispensed with who have acquired skill in their trade. It is a recognised fact that economic progress and invention are almost invariably followed by a diminution of the amount of labour required.

Unemployment.

What is to become of the unavoidably unemployed? The circumstance raises problems of a social and economic nature rather than medical. The displaced workers cannot altogether be left out of consideration. It is during the

* *The Health of the Workers*, Sir Thomas Oliver, page 57.

* *Monthly Labour Review*, Washington. Sept., 1927, page 32.

[Sport & General

UNEMPLOYED

An example of the wastage of man-power, with possible ill-health and defective feeding, which is the result of mechanical invention and industrial change.

period of "adjustment," when unemployed men and women are waiting and looking for work, that economic hardships are experienced by themselves and their families. New industries all the while are evolving, and these in due course may absorb several of the displaced workers, but machinery keeps improving and increasing at a more rapid rate than the rise of new industries. As oil and electricity are more and more replacing steam power, there is the opinion that in the future there will be a lessened demand for coal. Machinery for cutting coal at "the face" is replacing the hand-pick of the hewer. This too will primarily reduce the number of coal winners, but, as by machine cutting a larger output will be secured, several of the displaced miners will probably find employment, on the surface, in the "screening" and "washing" processes. Unemployment is not only a wastage of the man-power of the country and a loss to the nation's wealth, but it may become the occasion of defective feeding of the children. It is desirable that all healthy men, until at least the age of sixty, should be employed, since most of them have families to support. The age at which men should cease work is less a matter of years than a Trade Union requirement. Machinery, by easing the burden of labour, may in certain trades enable men who are over three score years in age to continue to earn wages.

Industrialism is becoming more humane. Employers recognise the desirability of keeping their work-people physically fit, healthy and contented. Social contentment reflects the industrial health of a people. To the human side of industry greater attention is being paid in modern times. Although machinery in many instances lightens labour, it does not always do so. Production is becoming increasingly scientific, and, in order to be efficient, it calls for a higher standard of intelligence and greater aptitude on the part of the workers, while from

employers there is required greater consideration for the health and welfare of the employees. Hitherto factory work has been considered too much from the physiological point of view, but there is a psychological aspect to it as well. The National Institute of Industrial Psychology is giving attention, with encouraging results, to the study, for example, of industrial fatigue. In industry, as in education, sufficient efforts have not hitherto been made to ascertain personal aptitudes for particular kinds of work, and the field of usefulness most suitable.

Compensation.

It was only natural that the Workmen's Compensation Act (1897) which is an extension of the Employers' Liability Act (1870) should deal primarily with accidents occurring at work, but ere the close of the nineteenth century it was evident that, disabling as injuries received at work might be, there were illnesses due to occupation which were frequently fatal or so disabling, since the effects were permanent, that it was felt some of them should be compensatable. The Factory and Workshop Act (1901) was meant to accomplish this. The act requires that cases of industrial lead, phosphorous, arsenical and mercurial poisoning, also of anthrax, must be reported to the Chief Inspector of Factories, Home Office. A few years later, it was decided to extend the list by including industrial poisoning by carbon bisulphide, aniline and benzene, also cases of toxic jaundice and of epitheliomatous and chronic ulceration. The Employers' Liability Act dealt with accidents, of the relationship of which to employment there could be no question. It is somewhat different with most of the occupational illnesses. In lead poisoning, for example, owing to the malady developing slowly it is impossible to state the particular day on which the disease reveals itself, or the particular increment of lead absorbed by the body which gives rise to symptoms. From the workmen's compensation

Courtesy] [*J. Powell & Sons (Whitefriars) Ltd. London*

GLASS-MAKING BY HAND

Blowing the bulb of a wine glass—a method requiring much care and skill, now largely replaced by machinery.

Courtesy] [Vitrea Union Bottle & Glassware Co. Ltd.

GLASS-MAKING BY MACHINERY

A scene in a modern glass factory in Czechoslovakia showing machines which turn out thirteen bottles a minute.

point of view the difficulty was to reconcile occupational disease with accident, the latter being an unexpected event and usually sudden in its incidence. In the case, however, of wool sorters' disease, a healthy workman, after opening a bale of infected wool, and inhaling the dust arising therefrom, to which the spores of anthrax bacilli are adherent, might develop an acute pneumonia and die within twenty-four hours after infection. In such, there is the definite fact of the exposure of a workman to infected dust, when following his occupation at a particular hour, followed shortly afterwards by a fatal event, in regard to the cause of which there is no doubt. It thus became necessary to make notifiable the industrial diseases already mentioned, of the humaneness and justice of which, so far as compensation is concerned, there can be no question.

Unhealthy Occupations.

It has long been known that environment may exaggerate the unhealthiness of some occupations. There is the opinion, for example, that railway clerks have a higher morbidity rate for tuberculosis than clerks in banks and commercial offices. All workers are liable to epidemic influenza in varying degrees, but taking 1000 work-people generally, for every 100 ill, 16.3 suffer from respiratory diseases, including pneumonia and tuberculosis, 18.1 from affections of the digestive organs, 10.2 from rheumatism, 10 from non-industrial accidents, 4.5 from diseases of the nervous system, and 3 from heart affections. Taking the morbidity rates of British railwaymen, the following are the figures as regards the organs affected.

	Members	Brain & Nervous System	Digestive Organs	Respiratory Organs	tory Organs	Kidneys
1916	11,196	135	228	350	50	40
1920	10,644	65	153	310	34	30
1923	9,619	67	159	257	38	44

[1] *Health of the Workers*, page 62. Sir Thomas Oliver.

Respiratory diseases in workers constitute the major cause of loss of time, but the number of days lost through minor complaints is also great. Many of these lesser ailments are of digestive origin or due to catarrh. Neglected colds frequently end in tuberculosis. Certain kinds of work equally predispose to the malady. Persons employed in overheated and overcrowded rooms, the air of which has become close and stagnant, as in many indoor occupations, are more liable to pulmonary disease than workers in the open air or operatives employed in well ventilated workshops. Owing to poor physique, many men and women seek employment in such sheltered trades, but their lack of robustness renders them liable to illness. There is, too, a large body of workers who, although not suffering from well-defined illness, say they never feel quite well. In many of them the indisposition is of a functional nature, but in others, these indefinite complaints are forerunners of real illness, or of degenerative bodily changes which ultimately render the individuals unable to follow their occupation. It is to these minor illnesses that medical practitioners of the family type should give attention, with the object of preventing, if possible, graver forms of disease following.

Male and Female Sickness. It is an interesting fact that while during childhood boys are less resistant than girls to disease, once adolescence is reached, females become the more susceptible, and this quite apart from conditions incidental to female life. The morbidity rate in females between the ages of 19 and 24 is as 1.3 to 1 in males. The United States Public Health Services have collected the records of disabling sickness among wage-earning males and females in 11 large industrial establishments, over a period of 5 years. In the illnesses were included only those where the disability lasted 8 days or longer, but excluded causes and conditions peculiar to females.

In three-fourths of these establishments the morbidity rate was higher among female than male operatives; in two of them, the male rate was higher than that of females.

ELEVEN INDUSTRIAL ESTABLISHMENTS

* Establishment	Ratio of Female Sickness to Male Rate	Establishment	Ratio of Female Sickness to Male Rate
A	2.46	G	1.07
B	2.11	H	1.04
C	1.94	I	1.00
D	1.79	J	.71
E	1.47	K	.55
F	1.40		

We cannot regard such data as quite comparable, for the average age of the male workers might have been higher or lower than, and the working conditions different from, those of the other sex. If, however, an industry is taken, such as a rubber factory wherein the working conditions are practically similar for both sexes, the ratio of female sickness to that of males, represented as 1, was between the ages of 15-24, 1.90; 25-34, 2.58 and 35-44, 2.57. One of the most reliable experiences bearing upon this question is that furnished by the Edison Electric Illuminating Company of Boston, which shows that there were annually 2.02 absences from work due to sickness among females to every absence among males, and that the excess of the female rate was greatest in the youngest ages, a circumstance which raises the question whether female morbidity is increased by factory employment, a point to which subsequently reference will be made. As bearing upon the subject under consideration, the tables of the Leipsig Local Sick Fund may be consulted, since they deal with 952,674 males and 259,582 females, under observation for one year, and with more than 1500 persons in each age group. The figures corroborate what has already been stated, viz., "that in the younger adult ages the female rate is in excess of the male, and that this excess diminishes as middle age approaches," also that in older ages the female morbidity rate is lower than in males. They also show that the ratio of female sickness to male rates between the ages of 20-24 is 1.24, between 25-29, 1.44; 30-40, 1.44 and between 35-39, 1.40.

That the higher morbidity rate in females is not entirely due to factory occupation is

* *Public Health Reports*, U.S. Public Health Service, July 29, 1907. Washington.

Courtesy] [Lever Bros Ltd

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HOW MODERN INDUSTRY CARES FOR ITS WORKERS

Above :—First aid in a works surgery at Port Sunlight *Below* . Girls taking refreshment in the garden at the Savoy Hotel Laundry during one of the rest pauses.

shown by comparing the illness reported among all males and females at different ages in a particular town wherein the morbidity rate of females to males between the ages of 20 and 24 was 1.75 ; 25 and 29, 1.94 and between 30 and 34, 2.06. In our own country, if all social classes are taken, it will be found that the female morbidity rate between the ages of 18 and 25 is slightly higher than that for males. Respiratory troubles constitute nearly 60 per cent. of the disabling illnesses of both sexes, and if these alone are considered it is found that the annual rate per 1000 sick persons, extending over a period of 3 years, is for the ages between 20 and 24, 384 males and 539 females ; between 25 and 29, 407 males and 586 females, and between 30 and 34, 437 males and 724 females. It is generally admitted that in most industries, more days are lost through sickness by female than by male operatives.

COAL MINING

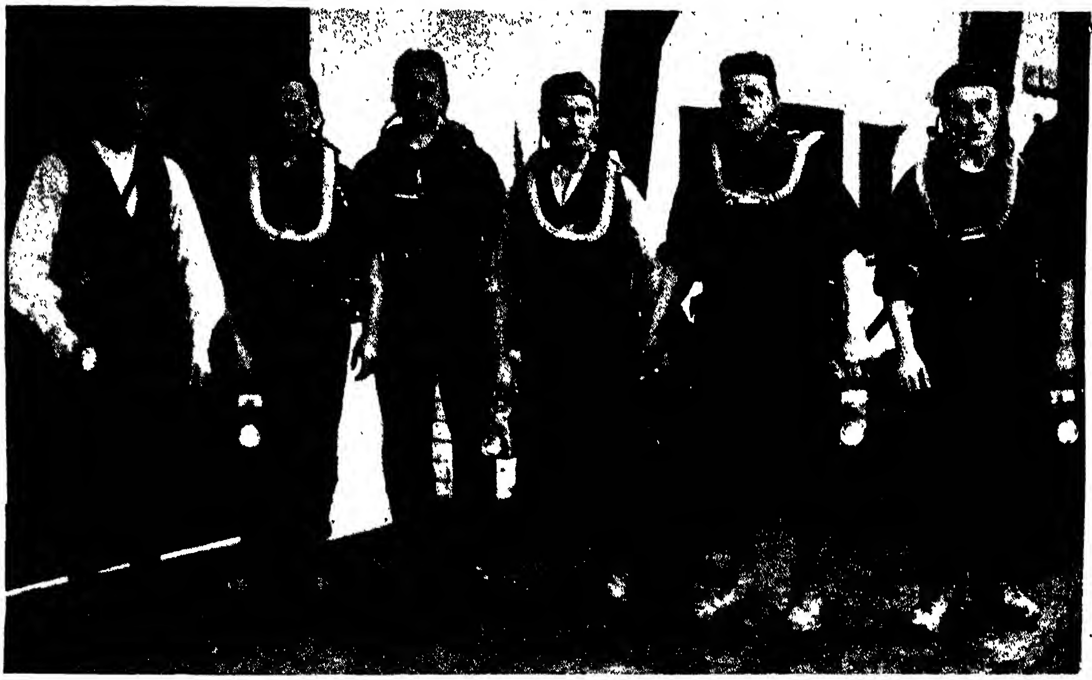
PERSONS working in dusty trades are particularly liable to pulmonary diseases. Miners, especially gold and tin miners, ganister miners and ganister brick makers, workers in potteries, also knife and razor grinders, develop, as a consequence of the dust inhaled, disease of the lungs whereby the spongy tissue of these organs becomes hard and inelastic. Although at its inception, and for some time afterwards, the malady is purely a dust disease, sooner or later the micro-organisms of tubercle invade the altered lung tissue and the patient ultimately succumbs to pulmonary tuberculosis. The term "pneumoconiosis" includes all forms of dust diseases of the lungs. Where, however, the malady is the result of inhalation of rock dust rich in silica, as occurs in gold and tin miners, the disease is spoken of as Silicosis ; when it is the consequence of inhalation of particles of iron the disease is known as Siderosis and as the result of coal dust Anthracosis. Pulmonary diseases of occupational origin are popularly known as gold miners' phthisis, steel grinders' phthisis, potters' rot and coal miners' phthisis.

Pulmonary Diseases.

Nature has placed in the respiratory tract of man obstacles to prevent dust particles reaching the lungs. Owing to the motile activity of the ciliary processes of the epithelial cells which line the interior of the windpipe and bronchial tubes, inhaled dust is wafted upwards to the pharynx, so that it may be expectorated, but as a consequence of repeated chest colds, the ciliated epithelium may become deficient or destroyed, and with this breakdown of the protective barrier, minute particles of dust may reach the lungs and induce fibrotic changes. For years the miner or worker in a dusty trade, if only slightly affected, continues to follow his vocation, the while the victim of cough and of increasing shortness of breath, with or without blood-spitting, but in course of time the anatomically altered lung becomes the prey of tubercle bacilli, when a fresh impetus is given to destruction of the pulmonary tissue. Such has been too frequently the fate of gold miners in the Transvaal, of ganister and tin miners at home, also of makers of Sheffield cutlery.

It has been said that practically every man who works a machine drill in gold mines dies from consumption. This statement requires qualification. Over thirty years ago on the Rand, the life of a rock-driller was five to six years, but since then, owing to improved methods of working and of surroundings, including periodical medical examinations of the workers, the span of a rock-driller's life has been nearly doubled. The tin miners of Cornwall have always shown a high mortality rate from phthisis. They have about five times the average mortality from phthisis compared with workers in healthy outdoor occupations, while cutlers and sandstone masons have an average of three times.

Although coal miners are exposed to dust, all do not suffer equally. Each coalfield has its own particular type of coal. If this is soft, although the miners' lungs may be black,



A MINERS' RESCUE PARTY

Equipped with special breathing apparatus, and with canaries to detect the presence of carbon monoxide gas.

the anthracosis is of a milder nature than that of hewers of hard coal which contains stone. In the former case the particles of coal have more the appearance microscopically of finely divided carbon, but in the latter the gritty particles irritate the lung. There is always one danger to which underground workers are exposed and that is inhalation of the fumes as well as the dust which impregnate the atmosphere from the firing of high explosive cartridges. The nitrous fumes occasionally give rise to severe headache, vomiting and palpitation. In order to avoid such possibilities miners should not return to the working face too soon after blasting operations; time should be given for the dust to settle and for the air to become cleared of the nitro products.

Coal getting has other hazards to which miners are exposed. There is always the possibility of accidents such as falls of stone from the roof, also the more remote possibility of explosions. Both, singly or combined, exact too high a toll of human life. The following table* supplies information relating to the

Accidents.

NUMBER OF MEN KILLED PER 1000 FULL YEAR (300 DAYS) WORKERS.

	United States	Great Britain	France	Belgium	
Average 1911-1915	4.65	1.35	—	—	2.37
Average 1916-1920	4.03	1.28	—	—	2.93
1921	4.19	1.08	—	.91	
1922	4.89	1.09	--	.91	

Mine accidents in Great Britain have been reported since 1851. During that year among the 216-217 thousand persons employed in coal mining the death-rate per 1000 employed in and about mines was 4.55, the highest ever recorded. Since 1851 each decade has shown a marked decrease. In 1854 there were 1045 persons killed in mining; in 1901, 1075 or 1.36 per 1000 employed; in 1910, 1754 killed or 1.70 per 1000 employed. The total number of persons employed in and about coal mines in Great Britain was in 1920, 1,248,224 and in 1922,

* Safety in Mines Research Board, U.S.A. Washington. W. W. Adams.

1,162,754. Deaths from explosions of fire-damp and coal dust per 1000 employed were in 1912, 0.14; in 1920, 0.03; in 1921, 0.02; and in 1922, 0.59. Taking 1911 as a pre-war period there were in this country* 1232 deaths of miners due to their occupation; of these 599 or 48.62 per cent. were caused by falls of roof or stone; 256 or 20.78 were due to coal haulage defects; while accidents from gas and coal dust explosions resulted in 34 deaths or 2.76 per cent. of the total number.

Fortunately explosions in coal mines are less frequent than formerly and they contribute less than might have been expected to the total number of deaths, only 4.06, but when they occur they call forth a large amount of public sympathy owing to the sudden loss of scores of men in a limited mining area, with, apart from the grief and terror created, impoverished families and widows left to bring up and educate their children.

* *Coal Mine Accidents in the United States.* Washington Government Printing Office, 1913.

Dangerous Gases.

Of the gases met with in coal mines, carbon dioxide (CO_2) causes the fewest deaths. It is a constituent of "black damp." It extinguishes the flame of a miner's lamp and when inhaled in considerable quantities produces toxic effects ending in unconsciousness and death. A much more dangerous gas is carbon monoxide (CO). This, known as "white damp," is produced during blasting operations, explosions of coal dust and gas, the slow oxidation of coal, also by mine fires. The gas is odourless, so that miners may go on working in a poisonous atmosphere for a time unconscious of the presence of the gas until they have a peculiar feeling of light-headedness and a buzzing in their ears, when, impelled by these symptoms to move away from the danger zone, their limbs fail to carry them, they fall unconscious and death rapidly supervenes. When rescuers reach the dead body of their comrade they find his lamp burning and his cheeks pale, or presenting a roseate hue, as if still alive. Carbon monoxide is a treacherous gas, so that rescuers have to proceed warily, carrying with them birds, usually canaries in a small cage, for, as birds are extremely sensitive to the presence of such small quantities as 0.2 to 0.3 per cent. of CO in the atmosphere, the sudden collapse of the birds is a danger signal, pointing to the necessity of proceeding with still greater caution, or it may be of beating a rapid retreat.

[*Topical*

AT THE COAL FACE

Showing the cramped conditions under which the miner works, in a foul and dust-laden atmosphere.

"After damp"

is the gas formed after an explosion and is a mixture of carbon monoxide and dioxide. Its poisonous properties are due to carbon monoxide.

Methane or marsh gas (CH_4) is the principal constituent of "fire damp." It is met with in disused workings and is the cause of explosions. It is this gas which reveals itself by the presence of a distinct cap around the flame of a miner's safety lamp.

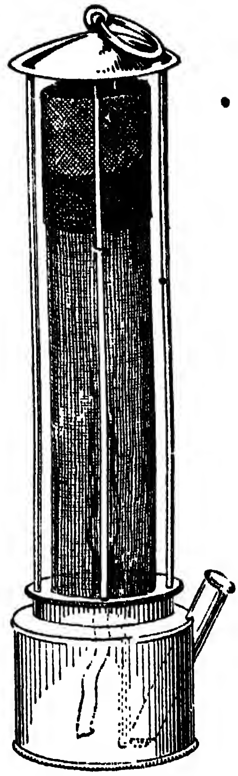
Apart from the risk of accidents and explosions, coal mining of itself is not an unhealthy occupation. Colliers are a long-lived class as shown by the following tables. Taking the mean annual death-rate per 1000, the comparative mortality figures of males aged 26-65 years for coal miners and all occupied males are herewith shown :—

	Coal Miners		All Males	
	1900-2	1910-12	1900-2	1910-12
All Causes	885	727	1,004	790
Phthisis	89	75	187	141
Cancer	53	61	69	78
Alcoholism ..	5	3	16	7
Valvular Disease of Heart	31	40	36	42
Bronchitis	79	50	58	37
Pneumonia ..	86	65	92	67
Bright's Disease ..	23	18	35	30
Accident	128	118	88	47

Miners are less liable to pulmonary consumption than the average population, also to a lesser degree to cancer. They also show a small mortality rate from alcoholism. Their liability to death from accident is 2½ times greater than that of males generally.

After the middle period of life there is a rise in the mortality rate of coal miners. Between the years of 45 and 55 the death-rate is double what it was in the preceding decade. There is a difference in the mortality rates of miners employed in the various coal-fields. Those of Lancashire are the highest.

Another malady which afflicts miners and which has assumed prominence, since the Workmen's Compensation Act became operative, is NYSTAGMUS, an involuntary rapid movement of the eyeballs, which may be lateral, vertical or rotary and especially revealed when the individual looks downwards or when any conjugate movement of the eyeballs is attempted. It is regarded as an occupation neurosis, and is generally attributed to miners working with poor illumination in a cramped position. The ocular muscles as a consequence become fatigued. The pathology of nystagmus is not yet known.



A MINER'S LAMP
The lamp can be carried without danger in an explosive atmosphere since the flame cannot penetrate the fine metal gauze.

Among the lesser ailments to which miners are liable may be mentioned "BEAT HAND," a painful inflammation of the cellular tissue underneath the palm of the hand, and indirectly the result of friction through the individual gripping tightly the wooden handle of his "pick." Occasionally the inflamed area becomes septic and requires surgical treatment. The miner too suffers more than men in other occupations from dislocation of the cartilage of the knee joint. The reason for this lies in the fact that miners are, by the nature of their work, frequently compelled to adopt a crouching attitude with the knees flexed and turned outwards. This position puts the ligaments and capsule of the joint on the stretch, to some extent weakening it, with the result that any sudden muscular effort may wrench loose the cartilages within the joint.

SILICOSIS IN THE POTTERY INDUSTRY

"Potter's Asthma."

Recently, as a result of trade union activity, an attempt has been made to have "potters' asthma" scheduled as an occupational disease. Accordingly two of the Medical Factory Inspectors of the Home Office* examined and reported

*Home Office Report on *Incidence of Silicosis in the Pottery Industry*, by Dr. C. L. Sutherland and Dr. S. Bryson, London, 1926.

[Photopress

YOUNG MINERS ON HOLIDAY

Nottingham pit boys sun-bathing in the Alps as part of an experiment undertaken towards improving the health of the miners.

was highest, viz., 17, in persons who had worked 40 years or more. As a result of their examinations the investigators are of the opinion that silicosis exists in workers in the pottery industry to a considerable extent. For the protection of the workers it is recommended that there should be frequent cleansing of the workrooms, including the walls, that the floors and benches should be formed of impervious material, that there

upon the examinations of the lungs of 344 male and 224 female workers, supplementing these with radiographic examinations. It was known that silicosis affected pottery workers exposed to dry flint dust in the manufacture of China, but there was doubt as to whether the malady existed in persons employed in the manufacture of earthenware, where sand or crushed silicious material replaced ground flint. One important result of the inquiry was that long before radiological examination revealed the presence of fibrosis of the lungs the disease could be diagnosed by careful medical examination of the chest.

It was clear that the altered condition of the lungs could be induced by the inhalation of dusts other than silica, and that the malady bore a distinct relation to the number of years the workers had followed their employment. The disease did not show itself to any striking extent until men and women had been in the trade 20 to 25 years, when it was found that the numbers affected were 14, that the number remained slightly above this level during the next two quinquennia, and that it

should be no deposits of waste on the floors, and that overalls should be provided, with frequent washing of same, to all persons handling clay containing over 10 per cent. of flint.

In the making of ganister bricks for lining the interior of iron blast furnaces, considerable clouds of dust arise, and as the dust contains large quantities of hard, stony particles it is extremely harmful to the lungs when inhaled.

THE CUTLERY INDUSTRY

In the Sheffield industries the dry-grinding of the blades of knives and razors has long been regarded as an unhealthy trade. The steel dust is particularly hard and irritating, and when inhaled produces a fibrous infiltration of the lung which predisposes to tubercular infection. By automatic water spraying and the use of downdraughts the risks to health have been diminished. There is still, however, among steel grinders a high mortality rate from pulmonary diseases.

THE TEXTILE TRADES

THE COTTON INDUSTRY

In the cotton industry there has been within the last few decades distinct improvement as regards illness attributable to occupation. The mortality rate has fallen from 303 between the periods 1900-2 to 214 in 1910-12, and it has since then declined further. Cotton operatives have a higher morbidity rate than workers in other textile trades. They do not exhibit a high death-rate from tuberculosis. Their maladies are chiefly associated with the nervous system and with the respiratory and circulatory organs. There is a high morbidity rate of bronchitis. Attempts have been made to associate this with breathing an atmosphere polluted by smoke. As the result of an inquiry in Lancashire the records show that while the townspeople have practically the same general mortality figures as mill workers they have a respiratory mortality rate of 113 for bronchitis compared with 142 for cotton operatives. There is no evidence that this high mortality rate is due to smoke.

* SELECTED OCCUPATIONAL MORTALITY FIGURES (MALES)

Causes of Death	Cotton Operativ 902	1910-12	1910-12 Strippers and Grinders	Blowing-room Operatives	Other Textile Workers		
Phthisis ..	197	120	155	136	128	187	142
Cancer ..	72	71	59	85	80	68	78
Diabetes ..	11	10	8	12	11	10	10
Nervous Diseases	128	94	72	109	91	103	85
Valvular Heart and other Circulatory Diseases	270	134	274	252	127	146	118
Pneumonia ..	109	70	113	87	63	92	67
Bronchitis ..	92	57	150	126	47	58	38

Cotton operatives as shown in the preceding table are more liable than males generally to diseases of the heart and circulatory organs. Cotton weaving has generally been regarded as a healthy occupation for women. Male operatives suffer more than females from chest diseases, and the latter more than males from digestive and nervous affections. Dearden found that male spinners lost less time from sickness than female, but allowance must be made for female absenteeism owing to maternity and incidental derangements.

NUMBER OF DAYS OF SICKNESS PER MEMBER PER YEAR OF THREE APPROVED SOCIETIES

	Males	Females
Card and Blowing-room Operatives	9.8	10.8
Operative Spinners	8.0	14.0
Weavers, Winders and Warpers ..	9.8	12.6

Humidity and Fatigue. For the manufacture of cotton a moderately humid atmosphere is required. This circumstance explains why cotton goods are so successfully manufactured in Lancashire. Temperature generally runs in the mills concurrently with humidity. Although little variation in atmospheric conditions is required for spinning, a slightly higher relative humidity is necessary for weaving. For spinning a fairly high temperature is needed and this has to be maintained with little variation throughout the year. Cotton fibres become more pliable and spin more readily when their waxy content is softened by heat. Wax melts at 80° F.

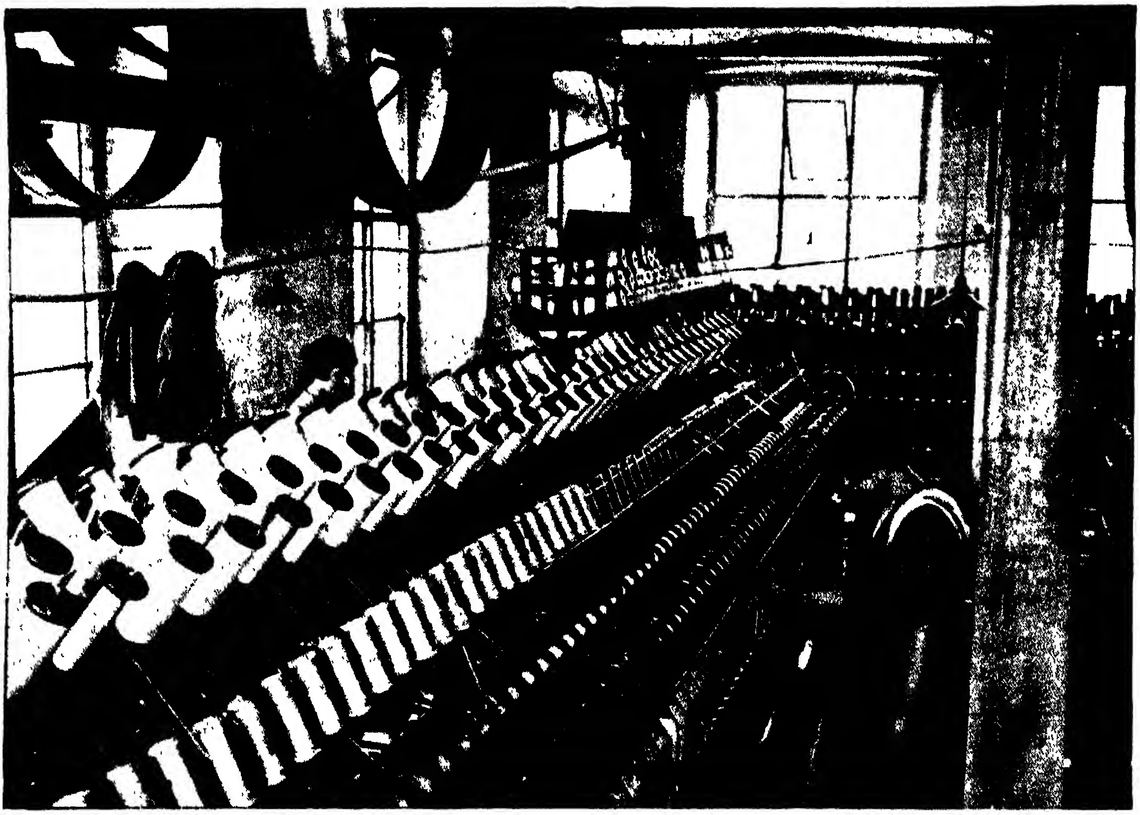
The temperature in the workrooms is caused to vary slightly with the kind of finished cotton goods required; fine counts require a temperature of 85°-90° F., and coarse counts 70°-80° F. When the temperature is higher, *e.g.*, 90°, it is not uncommon to find the spinning room operative, towards the end of the day, tired and showing signs of fatigue. A certain amount of moisture is necessary in the spinning mill, for a dry atmosphere renders the cotton fibres brittle, so that they break more readily and also do not twist so well. When moisture is deficient in the air of the workroom, the cotton fibres on passing rapidly over metallic surfaces become electrified. By providing a relative humidity of 40-50 per cent. this

* *Health Hazards in the Cotton Industry.* Milroy Lecture, Royal College of Physicians, 1927. W. F. Dearden.

electrification can be considerably prevented.

In a cotton factory, operatives are exposed to dust in the carding room, to humidity in the weaving sheds, and also to high temperatures. The dust given off in the carding room is frequently harmful to the eyes, or it may induce nasal catarrh, but admitting this, it is better to have exhaust draughts and free ventilation provided in the workrooms than that the workers should wear goggles or masks. There is always a considerable quantity of dust in bales of cotton as they arrive at a factory, and when these are opened by hand the atmosphere soon becomes thick and unpleasant to breathe, but since mechanical bale-breakers with exhausts have been introduced the air remains tolerably clear, for the dust is carried away by strong draughts. Carding and stripping are unwholesome processes. Raw cotton as delivered at a factory contains dust of vegetable and other origin. In transforming the raw material into cloth, mineral matter has to be added. During the breaking of bales there are found, in the dust given off, short cotton fibres ; in the scutching department where the raw material is beaten and mechanically pulled asunder, the dust evolved contains broken plant seeds, husks and sand, while during carding or where the separation of the fibres occurs preparatory to spinning, the dust contains fine vegetable debris and sand.

Microscopical examination of the dust caught by the collecting boxes under the carding machines shows metallic particles, cotton fibres, spores, molds, bacteria and crystals of silica. The operatives who empty and keep clean these dust collecting boxes are liable to asthma, but with the week-end off and resting at home they are generally



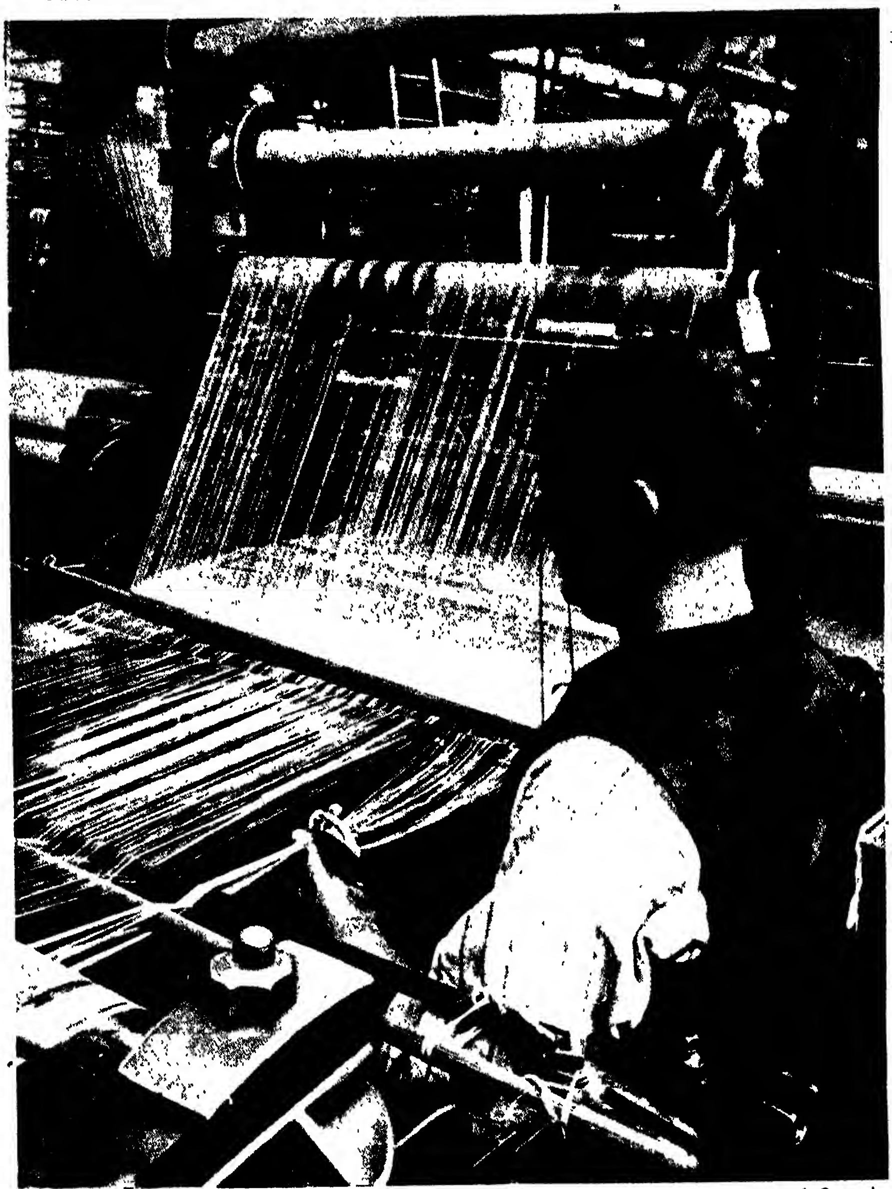
[Sport & General

AT WORK IN A COTTON FACTORY

Tending the spinning machines—a tiring occupation since it involves long standing in a warm, damp atmosphere, and close attention to the travelling threads.

fit for work on Monday. To operatives taking up work for the first time the dust is irritating to the eyes and may cause conjunctivitis, while older workers tend to become anæmic, to lose their appetite and to suffer from headache and vertigo.

A large number of cotton operatives are young females. Standing and working all day in an overheated and moist atmosphere is a trying ordeal for them. Several of the women suffer from varicose veins, ulcers of the legs, flat feet, and uterine displacements. Among the men engaged in the mule spinning department varicose veins, varicocele and flat feet are not unknown. In cotton factories work commences usually at 7.45 a.m. Since many female operatives do not make a good breakfast on leaving home in the early morning, the introduction in the mills of a short rest-period between 9.30 and 10 a.m. has been helpful to the workers, since it allows them to have a cup of tea and such light food as they have brought with them. Some employers supply milk, malted milk, oxo, bovril with biscuits at a nominal rate. In mule spinning there are no stoppages except for cleaning, and linking up broken threads.



[Sport & General

THE CAUSE OF "TWISTER'S CRAMP"

A "twister" joining new threads to a warp—a complicated operation which may produce pain and weakness in the thumb muscles.

Accidents and Fatigue. Mr. J. H. Crabtree, H.M. Inspector of Factories, dealing with the occurrence of 1000 accidents in the Oldham area, found these to be for each day of the week 163 for Monday, and on succeeding days 196, 150, 171, 195

and on Saturday 120; also that the largest number of accidents happened in the forenoon, 10-11, 150, and between 11-12, 134; also in the afternoon 3-4, 112, and 4-5, 107. Many opinions have been expressed as to why more accidents happen on one particular day of the week than another, also as to the hour of the day, but they are guesses rather than explanations. Fatigue is said to be a cause, also over-excitement towards the end of a shift, or that the work is being done automatically, without the necessary attention being paid to it. Fatigue and efficiency are inversely related to each other. In weaving, the accidental breaking of the yarn is one of the principal causes of the machinery stopping, and time is absorbed in restoring the continuity of the threads. Efficiency in this department depends upon few stoppages of machinery and upon the rapidity with which the worker readjusts the broken threads. Wyatt, on the other hand, found that the highest degree of efficiency was observed on Tuesday morning and that there was a slight decline during the remaining forenoons of the week. He found the percentage decrease to be as follows:—

	Percentage Decrease in Working a.m.	Capacity
Monday	1.6	5.5
Tuesday	0.0	6.2
Wednesday	1.1	6.3
Thursday	1.5	6.7
Friday	2.3	7.5

As there is such a condition as "cumulative fatigue" due to incomplete recovery from the effect of previous days' fatigue, it has been sought to explain the percentage decrease in working capacity, from Tuesday afternoon onwards, by this circumstance.

"Twisters' Cramp."

A minor trouble to which cotton weavers are liable is "twisters' cramp." It is the result of fatigue of overworked muscles of fingers and hands of operatives who are known in the mills as twisters or loomers and whose duty it is "to join the ends of a new warp to the warp ends of a woven piece." Attention was first drawn to this disability by Dr. Bridges, H.M. Medical Inspector of Factories in 1919. Twisting of the fibres is a complicated process in which the muscles of the left forearm, thumb and index finger are called into action. The twisters complain of pain at the base of the thumb, tenderness and weakness of the muscles, also of loss of power in the thumb. There is frequently flattening of the muscular substance at the ball of the thumb indicating atrophy.

"Shuttle kissing" is a disagreeable practice, but it is falling into disuse. When a shuttle required to be threaded and a fresh crop placed therein, the weaver frequently placed the eye of the shuttle to his lips and with a strong inspiratory effort drew the thread through. This might have to be done four or five hundred times a day, and as the same shuttles had similarly been "kissed" by other workers previously, not only was the practice objectionable but a possible means of spreading infectious diseases such as diphtheria, syphilis, tuberculosis and septic sore throat. A committee of inquiry was appointed to investigate the matter, but in only two instances was there evidence of syphilitic sores on the lips. Although there was little disease found to support the contention, it was, however, the unanimous opinion of the committee that it was an objectionable practice, and that some mechanical method for threading the shuttle should be adopted. This has been done, but the practice of shuttle kissing has not yet ceased.

Weavers' cough is a malady to which Prof. E. L. Collis drew attention in 1913.* There had occurred a series of outbreaks in certain factories, particularly among workers in dry sheds where the woven cloth was about to be bleached, dyed or printed. The malady gave rise to shortness of breath and cough accompanied by the expectoration of greenish material. The difficulty of breathing was of an asthmatic type. The strain of coughing was frequently followed by vomiting and nose bleeding. There was usually an evening rise of temperature. The malady resembled that known as aspergillosis which is due to a mold. Collis found that the cotton warps

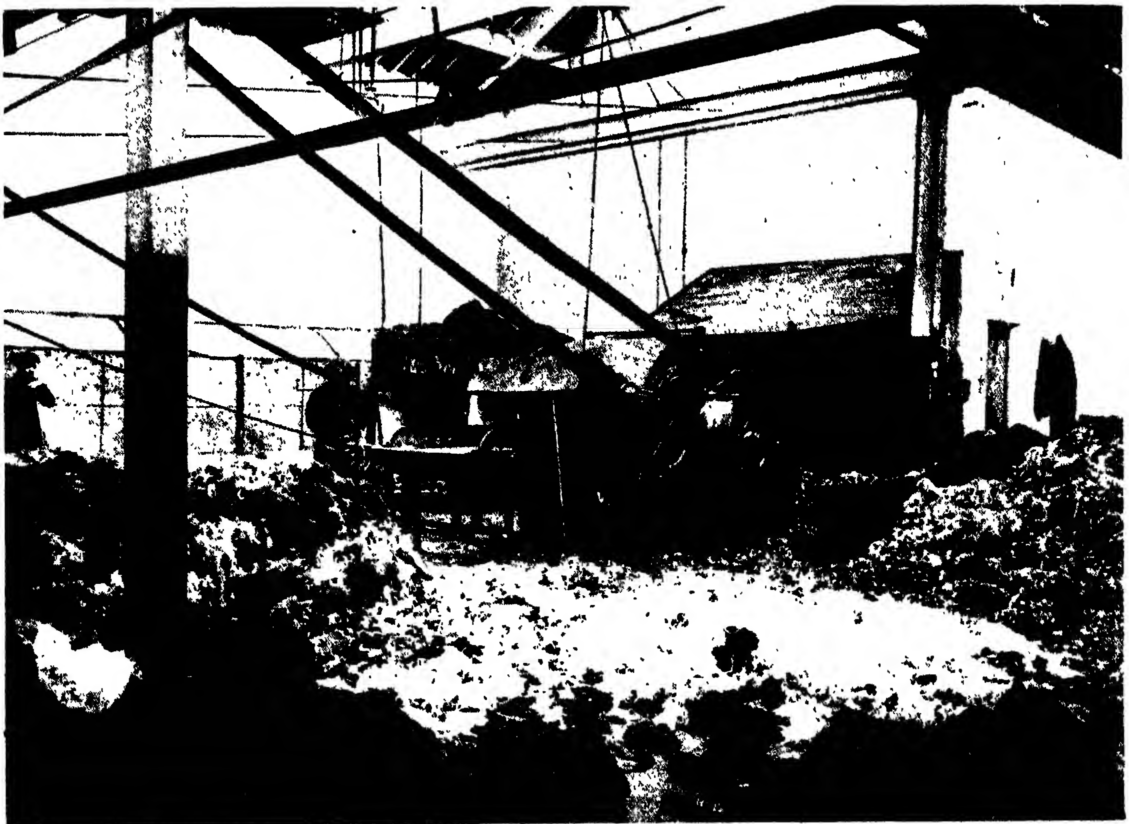
* *Report on an Unusual Illness among Weavers of Cotton Cloth.* H.M. Stationery Office.

contained less than the usual quantity of *size* and that zinc chloride, which had been the antiseptic hitherto added, had been omitted. The warps had not been sufficiently dried after being sized and had become covered with mildew. The following experiment was made. In one large weaving shed 500 looms were supplied with "dry-taped" warps, and other 500 with "wet-taped," with the result that only those weavers who worked with or near the "wet-taped" warps became affected. By using therefore only "dry-taped" warps the malady disappeared.

Temperature and Humidity.

The two conditions of the atmosphere under which all life is carried on are temperature and humidity. These play an important part in occupations. This is particularly true of the manufacture of cotton. The atmosphere of any indoor trade carried on in overcrowded rooms is frequently polluted by excess of carbonic acid gas, and by animal products thrown off in respiration. Chemists are disposed to regard these as likely to do less harm to the workers than stagnation of the air. This was shown experimentally by Paul and Ercklenz, who placed different persons in a glass chamber and gradually raised the amount of CO_2 to 10-15 parts per 1000. No symptoms followed, but when the temperature of the cage was raised to 78° F. with moderate humidity the subjects of the experiment began to experience discomfort, a congested feeling in the head, dizziness and a feeling of nausea, all of which declined when the impure atmosphere inside the chamber was whipped into motion without the admission of fresh air. The quicker circulation of the impure air decreased the heat of the body and, by favouring evaporation of the moisture, gave relief.

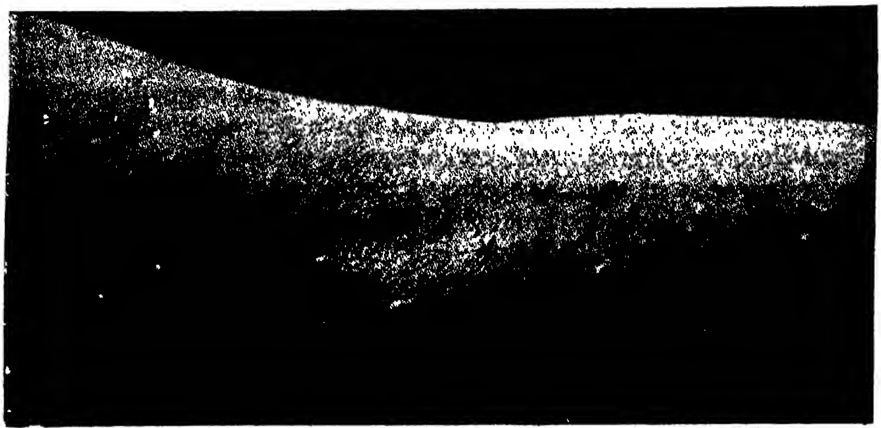
Here at home with our temperate climate we know nothing personally of the effects of the extremely high and low temperatures of



[*Sport & General*

SORTING WOOL IN THE CLOTH INDUSTRY

A dusty process which gives rise to respiratory affections, with the possibility of infection with anthrax.



Courtesy] [" Diseases of the Skin," J. M. H. MacLeod (London : H. K. Lewis & Co.)

"DOFFER'S DISEASE"

A skin eruption, rather like smallpox, occurring among "doffers" who remove the full bobbins of linen and cotton thread from the oily spinning frames.

the tropical and torrid zones. Cold is better borne than heat, and as regards sex, women react more readily than men, while children and old persons, owing to their heat regulating mechanism not acting so rapidly or successfully, are more easily affected. Just as there is a relation between temperature and efficiency, so is there a relation between accidents in factories and temperature. H. M. Vernon, obtaining his data from munition factories as regards the relation of industrial accidents to work, found that the minimum accident frequency as affecting men and women lay between 65° and 69° F., that when the temperature was from 50°-54° the accident rate increased 35 per cent., and that with a temperature above 75° F. it became 39 per cent. higher than that at 65° to 69° F.

As regards production in cotton mills and the prevention of accidents, good illumination is essential. There is a large amount of machinery concentrated in the workrooms much of which moves over a considerable distance and this of itself becomes a source of danger, while in the spinning and weaving departments the operatives have to keep close watch upon the travelling threads so that unless the light is good serious ocular strain may be produced.

By the employment of many women in the cotton mills those who have young children are obliged to make provision, during the time they are at work, for the care and feeding of their offspring. Many of the children are taken in the early morning to a crèche, others are looked after by elderly relatives, or are handed over to women who for payment act as foster mothers. When the women leave the mills at five o'clock, at the close of the day's work, they call for the children on their way home, open their dwelling and arrange the evening meal. Thus, at the close of the day's work in the factory, are imposed upon women with young children home duties and the care of family.

Care of Children.

THE WOOLLEN TRADES

In the manufacture of woollen goods the processes are almost identical with those observed in cotton mills. If the uncleansed wool is sorted out upon ordinary perforated tables it is a dusty process, but this is modified as there are usually means provided for drawing the dust downwards and away from the face of the operatives. The dust has frequently been the cause of catarrhal infection of the naso-pharyngeal and respiratory mucous membranes, but if certain kinds of foreign wool are being sorted these may give rise to anthrax or "Wool Sorters'" disease, to which reference is made further on.

FLAX AND LINEN

The manufacture of linen is an Irish industry, having been introduced into the North of Ireland by the Huguenots nearly 300 years ago. As practically all the flax grown in Ireland is used up in the factories, the farmers have to import seed from Flanders, formerly also from Russia, owing to the fact that flax to be of use industrially has to be pulled early and steeped in water, before being allowed to run to seed.

Work in linen factories is hard, the workrooms are frequently hot and the atmosphere humid, or dry and dusty. One of the dusty processes is "heckling," that is where men or boys dress and sort the rough flax which is about to become converted into tow by being passed through heckling machines. The dust creates a dryness of the throat and causes bronchial irritation attended by cough. In the spinning department, as in that of cotton mills, the temperature is high and the atmosphere humid. These conditions tend to create fatigue. A few years ago, employees on taking up work for the first time suffered from an indisposition known as "MILL FEVER"—the symptoms of which are a sense of chilliness followed by a rise of temperature which lasts for two or three days, muscular pains attended by nausea, also vomiting and headache. While these may be largely the consequence of the effects of heat and humidity, the unpleasant odour evolved from the lubricating oils may also be a contributary cause. Occasionally there have been outbreaks of febrile illness amongst the workers, characterised by cough and asthma, and due to inhalation of a mold or fungus (aspergillosis). This has been observed more in Germany than in this country and is probably the result of protein poisoning in susceptible persons.

Eczema.

Men who are concerned with the steeping of the flax in water suffer from eczema, and from sores on their hands. Small ulcers are occasionally met with on the hands of operatives in the spinning department. Dr. H. S. Purdon of Belfast, some time ago drew attention to the occurrence of a skin eruption not unlike smallpox on the forearm, arm and face of the "doffers," viz., the young persons who remove the full bobbins from the spinning frames. At the time it was regarded as the result of the irritant action of the flax, oil and water upon the skin. Dr. Glibert, Medical Factory Inspector of Belgium, who has had considerable experience of workers in flax in Flanders, found abrasions and ulcers on the palmar surface of the hands of spinners. The skin becomes cracked and peels without pain, but as the deeper layers of the skin become implicated pain is experienced. The ulceration is peculiar to flax workers.

The tuberculosis death-rate of persons employed in linen mills is two to three times higher than among the general population. Females employed in the weaving department show a higher sickness rate than the spinners.

THE JUTE INDUSTRY

The raw material, a grass brought to this country mainly from India, contains a considerable quantity of dust. Adherent to the

[E. N. A.

FLAX-WORKERS IN FLANDERS

Removing the "retted" flax from the dams to dry—an occupation which gives rise to eczema and sores on the hands.

[Photopress

A CAUSE OF MILL FEVER
Workers who sort and clean rags for the manufacture of paper sometimes develop " mill fever," a condition with symptoms of hay fever.

dust are organisms which may become the cause of serious illness. This occurred at least on one occasion a few years ago, when there was an outbreak of tetanus among the factory workers in India and Dundee, and which was traced to the raw product containing the spores of the tetanus bacillus.

In addition to the ordinary respiratory troubles due to inhalation of dust, as in other textile trades, considerable damage may be done to the nervous system and hearing organs of the operatives by the excessive noise of the machinery. Whether the impoverished health is the result of the work itself and factory environment, or a consequence of the inadequate housing accommodation offered in Dundee, casual observers when watching the operatives leaving a jute factory in that town have been impressed by the dwarfed height and the poor physique of many of the

SPECIAL INDUSTRIAL MALADIES

OCCUPATION PYREXIA

REFERENCE has been made in preceding pages to peculiar attacks of feverishness accompanied by headache, nausea, distaste for food and loss of strength in workers in textile factories. A similar set of symptoms is met with in persons employed in rag factories where rags are sorted and cleaned preparatory to being converted into paper. In the " shoddy " trades such symptoms are frequently observed in newcomers. The

Mill Fever.

attacks, which are catarrhal and affect the nasal and respiratory passages, resemble "hay fever" and may probably be explained by some persons being more susceptible than others to the influence of protein bodies inherent in the raw material.

A similar hypersensitiveness is met with in grain millers and in carpenters working on teak wood, while in the case of bakers there is a varying reaction on the part of the skin to flour and other dusts evolved in the processes of baking. This hypersensitiveness on the part of certain individuals to the agents mentioned is known as "trade anaphylaxia," and may be met with in occupations of an entirely different order to those mentioned, for example, brass workers.

[Photopress

PROTECTION FROM METAL DUST (1)

Goggles and a shield over the grindstone prevent particles of metal from injuring the worker.

"Brass-Founders' Ague."

Brass pourers on taking up work for the first time are particularly liable to attacks known in the trade as "brass founders' ague." The symptoms usually disappear by the third day; they also cease during the pause from work at the week-end, and may return on the Monday if the men have resumed their occupation. The recurrent enforced absenteeism from work which the indisposition entails, even if only for a few days, remains a disturbing element in the industry, despite the many attempts which have been made to prevent it.

Courtesy] [R. & A. Main, Ltd., Falkirk

PROTECTION FROM METAL DUST (2)

A portable apparatus for spraying the grindstone with water during hacking. The dust evolved is driven into the box and does not reach the worker's lungs.

Further to this subject, the general risks to health in brass founding may for convenience be here alluded to. These arise from dust and fume. Brass is an alloy of zinc and copper to which other metals may be added, such as manganese, lead, tin and aluminium. Some of the dust evolved in brass founding is sand which has been sprinkled upon the moulds. Other types of dust such as graphite and lampblack may be sifted over the surface of the moulds. These dusts if inhaled cause dryness and irritation of the nose and throat, and induce cough. Much of the dust lying about

in a brass foundry contains considerable quantities of zinc oxide. During the pouring of the molten metal dense white clouds ascend, much of which in fine weather escapes through the roof and becomes deposited outside the factory or is dispersed by aerial currents. Such escape is a serious loss to the factory owner. In wet weather, the white clouds do not so readily find a vent, but tend to deposit their metallic particles in the foundry, to the detriment of the workers. It is the men employed in this department who suffer from "brass founders' ague." A degree of tolerance by the workman to the dust is sometimes secured. Others again complain of chilly sensations, headache, metallic taste in the mouth, redness of the eyes and of thirst. The body temperature may rise and be followed by sweating. The attacks in some respects resemble malaria, hence the use of the term ague, but they have no connection with malaria. Opinions are divided as to which of the two components of brass, zinc or copper, is the causative agent of the indisposition, but as the symptoms resemble those met with in oxide of zinc workers, it is more than probable that zinc is the harmful agent.

MALADIES DUE TO DUST AND MICRO-ORGANISMS

One of the most serious forms of acute illness in workers consequent upon inhalation of dust is anthrax or wool sorters' disease. It is the result of the entrance into the body of a rod-shaped organism, the *bacillus anthracis.* When it has penetrated the skin, through a slight crack or an abrasion, it gives rise to a carbuncle, which if excised early may not be followed by constitutional symptoms. On the other hand bacilliferous dust evolved during the opening of bales of infected wool in a factory may be inhaled. Within a few hours the unfortunate workman is found to be seriously ill. There will probably have developed a virulent type of pneumonia which usually rapidly runs to a fatal termination. The victim's blood is found on microscopical examination to be swarming with anthrax bacilli.

Wool-Sorters' Disease.

Men employed in the hide, skin and fur trades, also in the manufacture of hair and shaving brushes, have in a similar manner, but to a less degree, suffered, the malady more frequently assuming the local type, and therefore being more amenable to treatment.

The incidence of the disease has been much reduced by the improved mechanical methods of opening bales of wool in factories and the means used to prevent dust being inhaled by the workers. One of the most successful preventive measures has been the establishment by the Government of a disinfecting station in Liverpool for foreign wools. So satisfactory have been the operations at the disinfecting station that there is no instance known of anthrax having followed the manipulation of wool which has passed through the station. It is infected wool and hair from Asia Minor and the countries north of the Himalaya Mountains which have hitherto been the main cause of wool sorters' disease in this country, hence the necessity of disinfecting these at the port of entry.

Tuberculosis

Tuberculosis and occupation are causally related to each other, and yet it is not always easy to assign to occupation the exact part it plays in causing tuberculosis. Other factors may be in operation simultaneously with the influences of the trade which is followed. There is, for example, the possibility of tuberculosis established in infancy and lying latent all through adolescence. There is the influence of home conditions and how the worker spends his leisure hours. Contagion is the primary event, so that if an illustration were required of tuberculosis being an industrial disease none better could be supplied than that of workers in laundries becoming infected by handling dry clothing worn by, or soiled by excretions from a patient who has been suffering from the disease. There can be no tuberculosis without the concurrence of the tubercle bacillus, but the soil into which it is received is just as important as the organism. Tuberculosis is an infectious disease but it is mildly such. It may be transmitted from husband to wife and vice versa,

and a tuberculous child in an overcrowded family may infect others in the home.

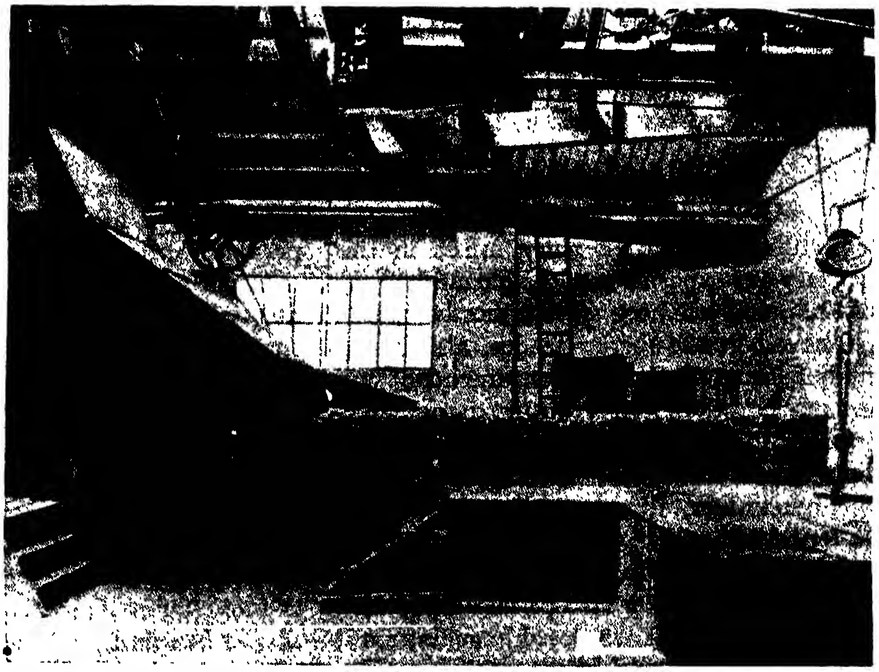
Since tuberculosis depends upon the presence of a specific organism, the microbe may enter the body through wounds of the skin, as, for example, in the case of butchers handling infected carcases, and in surgeons becoming infected during an operation.

The development and virulence of the disease are largely determined by the number of micro-organisms which enter the body, also by the vital resistance of the tissues of the infected person. Towards the latter many circumstances act unfavourably such as fatigue, prolonged work in overheated and ill-ventilated factories, inhalation of dust, poor feeding and alcoholism.

Dust plays an important part in paving the way for the development of the disease, hence the frequency of the malady in stone-cutters, gold miners, tin and lead miners. It is mine dust rich in silica which inflicts the greatest damage upon the lungs and which explains the comparatively short working life of a gold miner on the Rand, or a tin miner in Cornwall. Since the simultaneous introduction into gold mining of automatic spraying of water at the time the drills driven by compressed air are piercing the rock, the longevity of the South African gold miner has been extended by nearly five years. The silicious particles present in rock dust are extremely hard, and as they are not readily dissolved in the lungs, they irritate the pulmonary texture and change its spongy structure into solid and inelastic tissue, unfitted for the purposes of aerating the blood.

Up to this point the malady is a dust disease of the lungs, but it has also rendered the individual extremely liable to tuberculosis by having prepared the soil for the reception of the bacillus. Although coal mining is a dusty occupation yet where the coal is soft and has a large carbon content, even although the lungs of a collier may become extremely black, some protective substance seems to be operative, for coal miners are freer from tuberculosis than men employed in almost every other occupation, an immunity which is largely shared by limestone burners and cement workers.

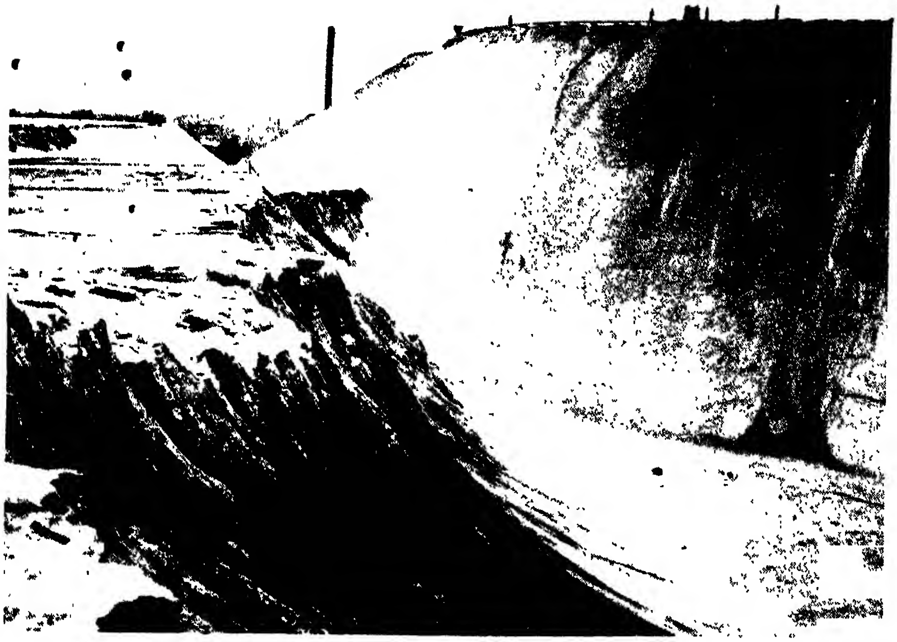
There is a degree of risk in a factory where a workman with open pulmonary tuberculosis is closely confined with his comrades, but the risk is light so long as the infected person is careful how he coughs, and how he disposes of his expectoration. If spitoons, containing disinfecting material, are distributed throughout the factory and are



Home Office Industrial Museum] *[Courtesy, the Controller, H.M. Stationery Office.*

THE WOOL DISINFECTOR AT LIVERPOOL

Bales of foreign wool entering the Government disinfector for the elimination of anthrax.



[F. N. A.

GOLD MINING ON THE RAND

A mountain of "tailings"—gritty rock dust discarded in the search for gold—which produces lung disease when inhaled.

the furnace and therefore can hardly avoid inhaling the fumes. As a consequence the smelters develop a peculiar series of symptoms and physical signs. They cannot walk properly but stagger and tend to fall in either direction. In addition the arms become the seat of tremors which become aggravated when any action necessitating muscular co-ordination is attempted. So violent do the tremors become that the men become practically unable to do anything for themselves; they cannot rise from bed, nor can they feed or dress themselves. Their symptoms are particularly aggravated by even a trifling quantity of alcohol. If the malady is treated early some of the men recover, in other instances death brings life to a close, after a long period of utter helplessness.

diligently used by tuberculous workmen, there is little danger to the health of the other operatives. The danger lies in the patient expectorating upon the floor, and in the material becoming dried and raised into the atmosphere as fine dust by the feet of the operatives.

MERCURY AND ITS FUMES

As there are no mercury mines in this country our experience of the harmful effects of the metal has been gained mostly in men employed in the furrier trades, also in the manufacture of scientific instruments of precision. Less than half a century ago, mirror-makers suffered from mercurial poisoning, but, since the substitution of nitrate of silver for quicksilver, illness attributable to the latter cause has disappeared. In the mercury mines on Mont Amiata in the North of Italy, the smelting of the ore is a primitive process; the furnaces which are closed have flat roofs, perforated here and there with openings through which the fumes escape. The men have occasionally to work on the roof of

In our own country mercurial poisoning is met with in makers of such scientific instruments as thermometers, barometers and manometers; also in persons employed in preparing rabbit and hare skins for the manufacture of bowler hats. The skins have to be pickled in a solution of nitrate of mercury, and if the skin of the hands of a workman is abraded there follow local inflammation and such constitutional symptoms as muscular tremors, sponginess and ulceration of the gums, offensive breath, loosening of the teeth, inability to take food and affections of the kidneys. The rabbit fur trade, however, is, practically speaking, no

longer a British industry. It has gone to the United States and is one of the trades there to which the government is giving attention.

OCCUPATIONAL SKIN AFFECTIONS

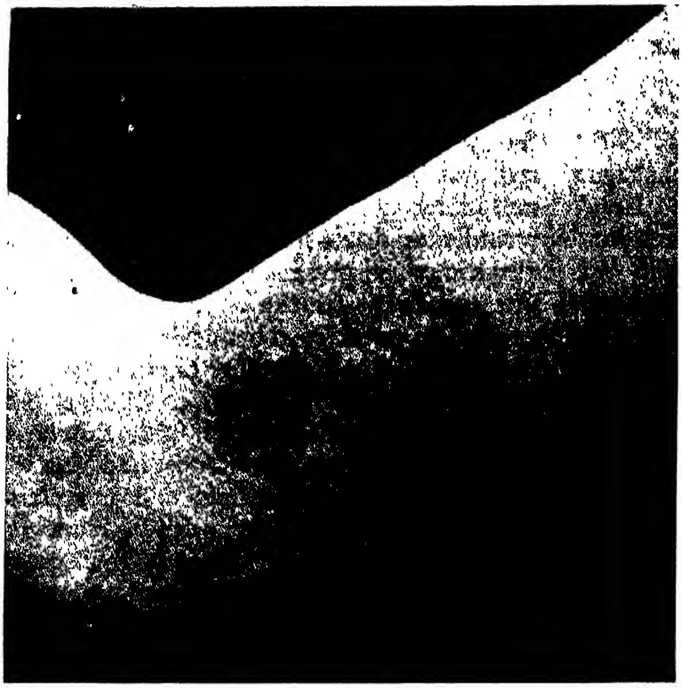
We have long been familiar with the terms "Grocers' Itch" and "Bakers' Itch." Formerly, the cause of the irritation and subsequent inflammation of the skin was attributed to the presence of a *mite* or *acarus* present in brown sugar, but other causes are in operation. One of the commonest types of skin disease, generally speaking, is eczema, due in most instances to external irritation. Probably one-sixth of all cases of eczema are the result of the occupation followed.

Irritation of the skin followed by the presence of small vesicles or boils is complained of by metal workers whose occupation brings them into contact with mineral oil. In operatives employed in engineering works, using as an aid to cutting an emulsion made of soap, mineral oil and water, the backs of the hands and wrists as well as the spaces between the fingers often become red and itchy; the skin becomes inflamed and thickened and crops of vesicles or pustules appear thereon. Although micro-organisms are present in the emulsion, the primary event in the skin trouble is the action of certain chemical constituents present in the oil; the micro-organisms induce a secondary infection. Similar, but less acute, forms of irritation of the skin have been observed on the hands and feet of female operatives in the linen mills in Belfast, on the hands of flax growers in Flanders, also in cotton spinners. The oils which cause trouble are of mineral and not vegetable origin, and especially waste oil which has

Courtesy] [McVitie & Price, Ltd.

GUARDING AGAINST "BAKERS' ITCH"

A doctor examining the hands and arms of workers in a biscuit factory for signs of eczema produced by prolonged contact with some of the ingredients.



Courtesy] [" *Diseases of the Skin*" *J. M. H. McLeod* (*London: Lewis & Co.*)

A CASE OF "BAKERS' ITCH"

A skin eruption breaking out in the form of small blisters which subsequently weep and spread the infection.

Irritation and inflammation of the neck and shoulders may result from wearing furs which have been steeped in chemical solutions.

As regards occupational dermatoses there is to them as to many diseases, a personal idiosyncrasy. There is in individuals a varying hypersensitiveness to impressions made upon skin by certain irritants, so that three factors have to be considered in occupational dermatoses; (1) the potency of the irritant; (2) the resistance of the individual, and (3) the reactive capacity of the skin.

Bakers' Itch.

Apart from such changes in the trade as the more rapid method of baking and a difference in the materials used, the Workmens' Compensation Act has given prominence to Bakers' Itch. In the Liverpool Skin and Cancer Hospital, between 1910-1921 there were 197 cases of this form of dermatitis dealt with; between 1910 and 1913, 18 cases; 81 between 1914 and 1918; and 91 between 1919-1921. In the North of England there has been of late an average of 60 cases yearly. Some of the men affected are absent from work for as long as from 6 to 9 months, and on returning to the bakery and working therein for a fortnight have a recurrence of the indisposition and have been obliged to leave. A few of the men cannot return to the occupation if the mixing has to be done by hand. Bronchial catarrh is not an uncommon incident, and for this the present method of bleaching flour is partly blamed, also the fine dust present in the air of the bakery. Baker's eczema is not a new malady, but statistics show that it has much increased in recent times. In order to ascertain, if possible, what is the agent in baking that causes eczema, Prosser White carried out a series of experiments upon himself. He applied to the skin, separately, the ingredients of the materials used in baking

been made use of over and over again. It is not exactly known what is the harmful ingredient in the oil.

The forearms and exposed parts of the chest of men who smelt antimony ores are frequently covered with pimples which cause considerable irritation, so too the backs of the hands and forearms of men engaged in the manufacture of tar products. The angry looking spots on tar workers have frequently a black head; the black dot is made up of particles of dust, inflammatory dermal cells and such micro-organisms as staphylococci. When a coal miner is stripped, it is not uncommon to find the back of his chest, the back of his hands and sometimes the skin of the face showing here and there bluish-black areas, as if the skin had been tatooed. These cause no inconvenience and do no harm. By some means or other fine particles of coal dust have become imbedded in the skin. Men employed in the manufacture of certain chemical compounds often exhibit sores upon the skin. Workers in alkalies are more liable to such than those engaged in acids.

bread, and in making confectionery, and he found that not one of the ingredients when applied in the " dry " state was harmful, but if " wet " some of them caused skin eruptions. These usually commenced in the form of small blisters which subsequently wept, thereby causing extension of the malady with aggravation of the itching. Dough is composed of flour, water, common salt and substances called " raisers." A piece of lint soaked in a solution of common salt, applied to the skin and worn as a dressing will cause redness of the skin and a papular eruption, hence a partial explanation of the inflammation and papular eruption occasionally observed on the hands and forearms of women employed in salting and packing cleaned herrings. Through cracks in their skin micro-organisms enter and set up ulceration, the irritation induced being proportional to the concentration of the brine.

Dr. Prosser White, in further experiments upon himself and others, placed upon the skin dough made from flour, water, dicalcine phosphate and common salt. On the skin of some of those who submitted to the experiment, pustules appeared, while in the case of others there was intense itchiness of the skin. When to the dicalcine flour there was added baking soda (bicarbonate of soda) making what is known in the trade as self-raising flour free from salt, and a paste of this was applied to the skin, the itchiness which developed was of a trifling nature. Confectioners' self-raising flour on the other hand, which is a mixture of dicalcine phosphate flour, with cream of tartar and baking soda, caused marked redness of the skin, attended by considerable irritation, and if dough contained sugar as well, the irritation was intensified. It is more than likely that it is not the presence of one or other ingredient in the dough which does harm, but their combination. Once bakers' dermatitis develops and is followed by anatomical changes in the skin, it is difficult to get rid of; resumption of work in many instances is quickly followed by a recrudescence.

Flour millers are liable to bronchial catarrh from inhalation of fine flour dust, but since the introduction of the milling of flour in closed machinery, there is less respiratory trouble than formerly. Confectioners may suffer in consequence of the high temperatures and from inhalation of the pulverised sugar. In some of them the sugar lodged between the teeth undergoes fermentation and induces dental decay. It has been stated that the sugar retained between the teeth stimulates the growth of pneumococci which are normally harboured in the mouth.

As bakers are on their feet a great deal, and the atmosphere in which they work is relaxing, flat-footedness is occasionally observed. So too is rupture, although much less frquently now than half a century ago. At that date the dough was made by hand; there was much lifting and mixing of the heavy masses of dough. Two men would mix as much as 40 stones of flour daily, and they frequently carried heavily laden sacks. Now that the transport of flour and the mixing of dough are effected by machinery, hernia or rupture is not nearly so frequently met with in bakers as formerly, although in the reports of their benefit societies there still appears to be a considerable expenditure upon trusses. According to the Registrar General's Decennial Supplement, 1921, bakers do not show a high death-rate. except for a seven per cent. excess between the ages of 20 and 25 years, the death-rate is below the average at every age. They have a tuberculosis mortality rate slightly above the average, but it is less than that observed in most indoor occupations. Bakers do not show a high death-rate from heart disease or cancer, but a slightly plus average for diabetes.

By the Bakehouses Welfare Order, 1927, it is required of occupiers that they shall provide suitable washing facilities and also suitable accommodation for clothing put off during working hours, with adequate arrangements for drying the clothing if wet. The Official Cautionary Notice displayed in the bakehouses insists upon scrupulous cleanliness, care of the skin and removal from it of all dough and sugar on leaving work, also immediate medical treatment on the appearance of signs of skin trouble.

METALLIC POISONING

OF all metals the one most largely employed in industry is lead. In one form or another it is associated with over 130 trades and industries, and has therefore been responsible for a great amount of occupational illness. Although there has been a marked decline in its incidence during the last forty years, lead poisoning still exacts heavy toll of human life and is the cause of a considerable amount of ill-defined sickness. The malady is known by various names, such as plumbism, saturnine poisoning and painters' colic.

Lead.

The disease may be acute or chronic. The acute form is usually ushered in by severe abdominal pain or colic attended by vomiting and obstinate constipation; when the malady attacks the brain there is excruciating headache accompanied by vomiting and followed in the worst cases by convulsions and death. In the chronic type there are loss of appetite and obstinate constipation, an indescribable sense of never feeling well, paralysis of the hands, wrists and of certain muscles of the forearm, both limbs being usually affected, also by the presence of albumen in the urine.

Courtesy] [Mersey White Lead Co

PROTECTION AGAINST LEAD POISONING

Workers wearing respirators while packing dried white lead under ventilating ducts, which eventually discharge the dust into cisterns containing water.

Plumbism is an extremely subtle form of poisoning. Usually of slow development, it is the result of the entrance into the body of lead in minute quantities, by the respiratory passages or the alimentary canal, continued over a considerable period of time. Occasionally the symptoms develop suddenly and without warning. Where men and women are exposed to the influence of lead, one of the earliest signs that the system is being harmfully influenced by the metal is pallor of the face, indicating anæmia, and if the blood is microscopically examined there will be observed a distinct reduction in the number of the red blood cells with a deficiency of the colouring matter or hæmoglobin, also possibly the presence of a few red cells whose contents show the presence of numerous bluish-black dots, hence the term "stippled" is applied to them, or basophilia. The presence of stippled cells in doubtful cases is of assistance in forming a diagnosis of lead poisoning; the cells are found in the early stages of the malady and tend to disappear. Their diagnostic value is somewhat diminished by the fact that "stippling" may occur in malaria and in pernicious anæmia. Notwithstanding these circumstances it is a sign of considerable importance.

As illustrating the decline of lead poisoning in this country the following facts speak for themselves. In 1900 there were notified 1058 cases of lead poisoning in Great Britain with 38 deaths; in 1906-08, 619 cases with 30 deaths; in 1924, 436 cases with 32 deaths, and in 1926 there were notified 242 cases with 28 deaths. While there has been a noteworthy reduction in the number of cases of plumbism reported to the Home

[By courtesy of the Sculptor

" THE METAL POURER "
From the statue by Albert Toft, F.R.B.A.

Courtesy] [Royal Sanitary Institute

A RESULT OF LEAD POISONING

Hungarian potters with paralysis of the wrists. The woman in the centre is suffering from dwarfism produced by the same poison.

Office, it would appear, at first sight, as if the mortality rate had not declined but proportionally risen. This circumstance is largely the result of several of the old cases notified years ago having only recently died from nephritis, the outcome of chronic lead poisoning. In the manufacture of white and red lead—industries which have hitherto given a large number of cases of plumbism — there were in 1900, 377 cases with 6 deaths; 1906-08, 94 cases with 3 deaths; in 1924, 20 cases with 1 death, and in 1926, 13 cases with 1 death. Clearly, therefore, those industries have been shorn of much of their power for harm. The reduction which has taken place in the number of cases of lead poisoning is encouraging. It is an illustration of what can be achieved by regulation, by exhaust ventilation, personal hygiene of the workers, and by cleanliness of the floors and benches. There can be, however, no slacking off as regards carefulness on the part of employers and employed, for even where exhaust plant has been installed this must be overhauled from time to time, as experience has shown that the exhaust through constant use may become blocked and thus become a cause of danger to the workers.

It is common experience that lead miners in this country do not suffer from plumbism. This is due to the fact that although the metal in the ore is in a comparatively pure state, it is also largely in the form of an insoluble sulphide. At the Broken Hill Mines of Australia, on the other hand, the men a few years ago suffered from the severer forms of lead poisoning, owing to the metal being present as carbonate (cerussite) and therefore readily soluble in the secretions of the human body. While the British miner runs practically no risk of becoming lead poisoned, he incurs other dangers connected with the inhalation of rock dust raised in the mine by the use of explosives and the ordinary operations connected with getting the ore, whereby his lungs become charged with minute particles of silica. He develops what is known as "silicosis," a dust disease of the lungs which frequently terminates in phthisis.

The danger from lead commences with the smelting of the ore. Formerly this was effected in open furnaces. The fumes evolved contain large quantities of lead in the form of oxide, and when inhaled by the smelters are a common cause of plumbism. In the remote dales of the County of Durham tall, solitary chimney stacks can be seen on elevated ground, far removed from human dwellings. These are the outlets for the smelting furnaces just mentioned, which may be perhaps a mile or two away. Between the two is a subterranean gallery through which

the fumes rich in lead are carried and from which in their course metallic particles are deposited. Here and there the gallery can be entered by a movable roof so that men can recover tons of lead dust, but the removal of the dry material is a dangerous process. It causes severe headache and deranges the digestive organs, so that the men must not work longer than two-hour shifts at a time.

During the war when lead was scarce it was locally believed that a gallery in one of the Northumberland dales, which had been in disuse for many years, contained large quantities of lead. It was opened at places and much material found, but some of the men who shovelled the dust, not having been sufficiently informed of the dangers, suffered severely from plumbism. When the furnaces are in operation, the fumes which escape from these solitary stacks fall upon pasture land whereon cattle may possibly be grazing. Several animals have in consequence died, and thus given occasion for litigation between farmers and the lead producers. The picture thus drawn is not peculiar to lead smelting furnaces in this country alone. A similar sequel of events has been observed in Australia and on the American Continent.

White lead or carbonate, owing to its ready solubility in the gastric juice and in the secretions of the respiratory tract, is of all the chemical compounds of lead the commonest provocative of plumbism. Formerly the manufacture of white lead had an undesirable reputation as a cause of illness among the workers, but the introduction of regulations, provision of washing appliances, recognition by the work-

[" *Elements of Hygiene*," C. Porter (O.U P.)]

A FACTORY RESPIRATOR

The type of respirator used in certain dusty trades.

White Lead.

people themselves of the dangers to which they are exposed, also the necessity of personal cleanliness, coupled with the replacement of hand labour by mechanical methods of production and transport, and also the substitution of *wet* for *dry* processes, have made the industry comparatively safe to what it was half a century ago. Abolition of female labour in the dangerous processes of the manufacture of lead compounds contributed years ago to the attainment of such satisfactory results, as regards the reduction of sickness amongst the workers, that employers have no desire to re-introduce this type of labour into the harmful departments of the manufacture of white lead.

Formerly the manufacture of red lead was just as dangerous as that of the carbonate, but new methods of manufacture whereby the escape of the finished material into the atmosphere is prevented have been followed by satisfactory results from a health point of view.

Lead poisoning is frequently met with in persons employed in the manufacture of metallic plates for electrical storage batteries. These are grids or perforated plates of metallic lead, the open spaces of which employees fill with red lead paste. During the weighing and mixing of the dry red lead, preparatory to the addition of liquid to form the paste, considerable clouds of dust rise into the atmosphere. Unless the men are wearing masks some of the dust is inhaled. Another cause of harm is the spluttered paste falling upon the floor or benches and when dried rising as dust. In some factories the employees wear leather gloves, but these are apt to crack and through the chinks the hands become besmeared, so that, if after a shift a workman is not careful to wash his hands before eating, his food may become contaminated.

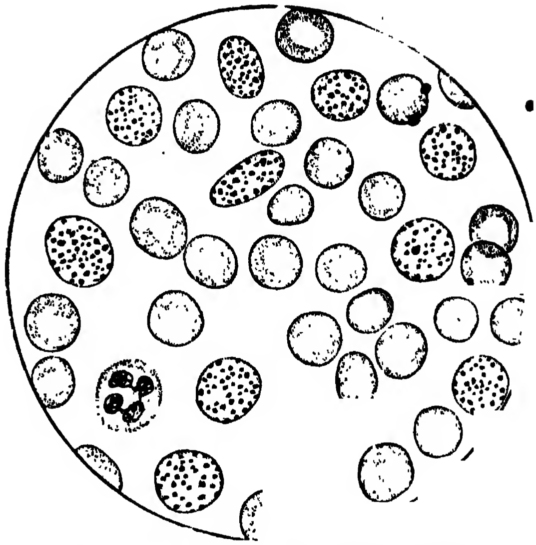
On the River Tyne and at Blyth there suddenly broke out since the war an epidemic of lead poisoning in men employed in breaking up old iron-clad ships of the British Navy. It was a comparatively new industry and the consequences had perhaps not been sufficiently anticipated. Between 1921-23

there occurred among the men employed, 21 cases of lead poisoning; in 1924, 131 cases with 1 death; in 1925, 31 cases, and in 1926, 8. The iron plates of the battleships had been cemented with red lead composition and, in order to break and dissever the plates, the workmen had to apply the flame of an oxy-acetylene lamp under considerable air pressure. In consequence of the intense heat the iron is quickly melted, so that in a few minutes comparatively thick plates can be cut through. If the workman is operating facing the wind he cannot, unless well protected by a mask, avoid inhaling some of the fumes. It was thus that several of the workmen became ill and had to absent themselves from their occupation for weeks or months. It is difficult to devise a satisfactory method for removal of the fumes, for the work is carried on in the open air.

In the manufacture of rubber for automobile and lorry tyres, white or red lead is occasionally sprinkled upon the rubber dough before it is passed through the rollers, or it may have been previously more intimately mixed with the material. The number of cases of plumbism occurring in the industry is small, three per year, but during the war the numbers were larger.

House and ship painting are still frequent sources of lead poisoning. Ordinary paint is a mixture of white lead, oil and turpentine. In the interior of a house which has just been painted the odour is not only unpleasant but is a cause of headache and vomiting. The indisposition has usually been attributed to the presence of lead in the vapour evolved, but carefully conducted chemical examination of these vapours from a freshly painted surface has failed to confirm the suspicion. To this event Professor Henry E. Armstrong has given close attention, and he finds that there is no lead given off in the vapour during the "drying" of a lead painted surface; there is, however, a certain amount of volatile matter, products of oxidation of the oil. To this may be added the vapour of the turpentine which had been included in order to expedite the drying of the painted surface.

Paint.



THE BLOOD IN LEAD POISONING
Showing the "stippled" cells—red cells with bluish-black dots—and the deficiency of colouring matter.

The morbidity and mortality rates of house and ship painters are higher than in most of the occupations associated with lead. In the men thus employed the illness usually develops slowly, with a marked predilection for the kidneys to be affected. For ships which put into port to be painted and which can only remain in dock from 24 to 48 hours, certain types of rapid "dryers" are added to the paints. If it is the interior of a closely confined space without adequate ventilation which is being painted, and naked lights are used, there is the danger of fire or explosion, but apart from this, as a consequence of inhaling the vapour the men may become unconscious and seriously ill. Quickly drying paints contain spirit. Turpentine is the spirit most frequently used, but benzol, petrol and tetralin may be substituted. Painters who are varnishing in the open air occasionally suffer from a sub-acute inflammatory condition of the eyelids from the turpentine, also from an irritating cough, but if they are working in an ill-ventilated confined space they may become light-headed or semi-intoxicated and suffer from painful micturition. Benzol is more dangerous than turpentine. Petrol on the other hand may cause poisoning, the principal sign being a form of drunkenness in the acute form, and

in the chronic, distinct anæmia. When tetralin has been inhaled there are headache, irritation of the respiratory passages, stupor and the emission of green coloured urine. There is less danger in using quickly drying paints for the outside of ships, since the work is carried on in the open air.

Preparatory to the renovation of painted surfaces in the interior of buildings, it has usually been the custom to burn off first the old paint by means of the flame of a lamp. The operation raises into the atmosphere fumes rich in lead compounds, the inhalation of which has been the cause of a considerable amount of sickness, and has led to house painting being regarded as an unhealthy occupation. Until recently, before painting the walls of a room, the workman, in order to secure a good and even surface, rubbed the dry walls with pumice stone. Owing to the dust evolved this too was a frequent cause of ill-health and led to the adoption of the "wet" method of rubbing down. Professor Henry Armstrong and Mr. Klein showed that by substituting the "*wet*" for the "*dry*" method of rubbing down, all dust was avoided and plumbism averted.

Spray Coating.

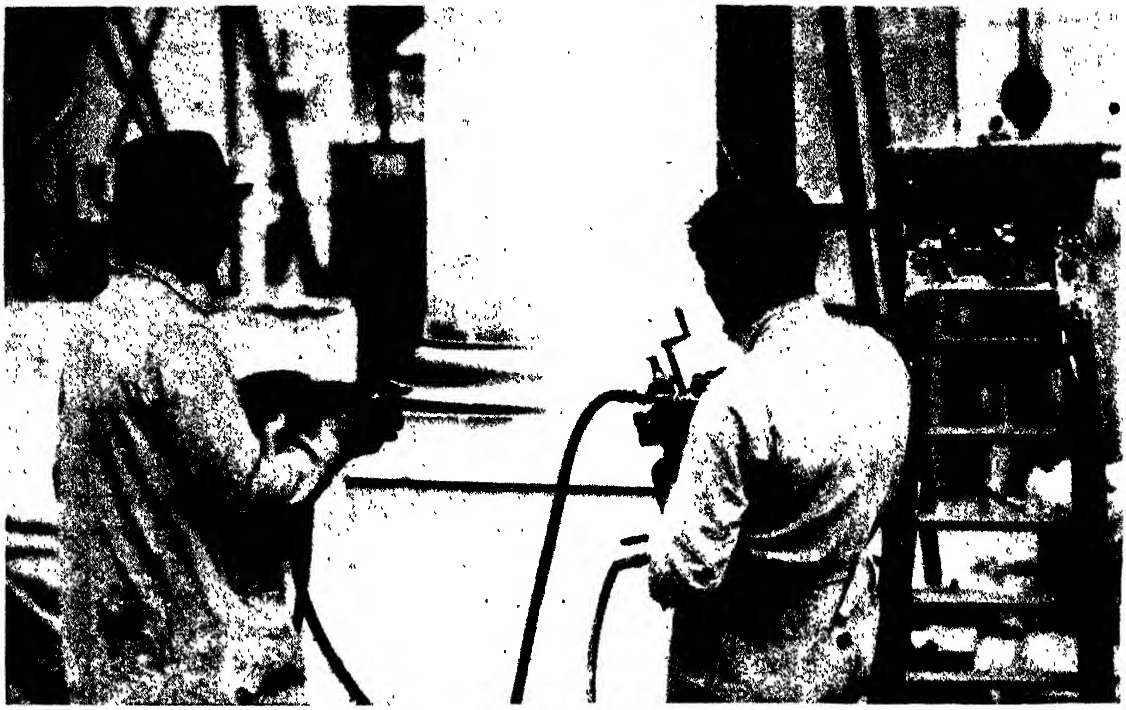
A new method of painting on a large scale has been recently introduced, in regard to the technical worth and hygienic value of which an absolute opinion cannot as yet be given. The spraying of surface coatings by means of compressed air came particularly into prominence in the United States during the war, when it became necessary, as the Final Report of the National Safety Council of Chicago reminds us, "to meet the productive exigencies of that time." Spray-guns and exhaust ventilation have accelerated, and made practicable upon extensive surfaces, the use of quickly drying paints in buildings and shipyards and on railways. No fresh method of painting on a large scale can, however, rise to its highest utility without creating health hazards to those employed. Spray-coating of large surfaces is carried out at Ford's works in Detroit, where the bodies of automobiles are thus painted and lacquered. In the potteries in Staffordshire the spraying of Majolica and other types of ware with lead solutions is attended with some danger. In 1915 Dr. Albrough, of Ohio, and subsequently Dr. Wade Wright, of New York, drew attention to plumbism attendant upon spray-coating. Since then numerous cases of plumbism have been reported following the spraying of paints composed of 60 per cent. of white lead and the remainder of linseed oil and turpentine.

In order to keep the material of proper consistency for spray-painting, benzol has to be added. Spraying is effected by means of compressed air. The fumes evolved tend to roll back upon the operator. In the urine of men thus employed 4-5 hours daily for a few days, lead was found to the extent of 0.3 mgrm., while in the immediate atmosphere in which the men were working traces of lead and benzol were detected. On microscopical examination of the blood of some of the workmen stippled cells were found. It is interesting to note, however, that although lead was found in the fæces of a large proportion of the men, and in their blood stippled cells were noticeable, there was no instance of one case manifesting both the positive blood findings and the diagnostic symptoms of plumbism simultaneously.

Prevention of Lead Poisoning.

All workers in lead processes should be periodically medically examined. Such symptoms as loss of appetite, a disagreeably sweet or metallic taste in the mouth, headache to which the workman has hitherto been a stranger, acute abdominal pain with or without vomiting, but usually accompanied by obstinate constipation, call for medical attention and treatment, with, in most instances, suspension from work for several days or a few weeks. Other signs such as double "wrist drop," due to paralysis of the muscles of the hands and wrists, also defective vision and convulsions, can only be dealt with by medical men.

The workers can do much to prevent themselves becoming poisoned, by wearing masks in dusty processes, wearing well-fitting overalls, rinsing the mouth and washing their hands before eating, keeping



[Sport & General

SPRAY-COATING IN PROGRESS

The modern method of applying surface coats of paint, in which the operators are apt to absorb fumes containing lead.

the workrooms clean and as free from dust as possible, also by having a warm bath before leaving the factory.

As regards the use of lead paint for buildings, while the Geneva Convention of 1921 recommended the prohibition of lead paints in the interior of buildings, the British Government decided to give regulations a trial. By the Lead Paint (Protection against Poisoning) Act, 1926, the Secretary of State was empowered to make regulations to prevent danger from the use of lead paint in connection with buildings. These regulations are now operative—some of the main provisions being that for the painting of buildings lead must only be used in the form of paste or paint, no spray must be used in the interior of buildings; scraping or rubbing down of walls must be done by the wet method; employers shall provide ample washing facilities, also that there shall be periodical medical examination of the workers. It was hardly to be expected that the Lead Paint Act would satisfy all parties in the State, but it strikes at some of the possible sources of harmfulness and is therefore worthy of a trial before resorting to prohibition.

POTTERY MANUFACTURE

Next to the white lead industry, that which has probably provided the largest number of cases of plumbism is the manufacture of pottery. In 1900 there were 210 cases of plumbism with 8 deaths; 1912-14, 57 cases with 11 deaths; in 1924, 47 cases with 18 deaths; and in 1926, 41 cases with 14 deaths. Although in the industry there is at present just about one-fifth of the number of cases of lead poisoning of a quarter of a century ago, the mortality rate has risen. The manufacture of pottery is one of the oldest arts. The home of the pottery trade in Great Britain is Staffordshire, due to the circumstance that it was in this county, decades of years ago, that the necessary fine clay was found in large deposits; also its proximity to coal fields—a relationship of importance since fuel on a large scale is required for heating the kilns and firing the products.

As far back as 1790 an Italian physician, Ramazzini, living in Padua, drew attention to the pulmonary dust diseases to which makers of pottery are liable. In our own country, Thackrah followed shortly afterwards, and he again was followed in more recent times by Dr. Arlidge who, while practising his profession in Staffordshire, gave careful study to the subject and accurately described potters' asthma and bronchitis. At this stage we are less concerned with the respiratory affections of the potter due to the inhalation of dry clay dust and other non-metallic material than with the occurrence of lead poisoning. This formed the subject of an inquiry in 1898.

Lead Glaze.

Just prior to this date there had been in the potteries an unusually large number of cases of plumbism reported with many fatalities. For the three years previous to the Thorpe-Oliver Report of 1899 the number of cases of plumbism in the pottery trades notified to the Home Office was 478 males and 607 females, a total of 1085 or an average of 361 per year. It was found that many of the manufacturers were recklessly adding larger quantities of white lead to the glaze, in which the individual pieces were dipped, than was necessary. The danger of plumbism arises during and after the earthenware and china have been dipped in the liquid glaze, which is a mixture of finely powdered clay and white lead suspended in water. Having been dipped, the articles are "smoothed" or rubbed with a cloth to remove minute excrescences of semi-dried glaze, also to give an even surface, after which they are each carefully placed, separately from each other, in large clay caskets or "saggers" made of coarse clay and capable of withstanding extremely high temperatures. The saggers when filled are placed in the cone-shaped kilns, so familiar to travellers through Staffordshire, to be fired.

It was evident that the main causes of plumbism among the workers was the excessive quantity of white lead in the glaze, and, when inhaled as dried dust, its ready solubility in the secretions of the human body. Thus one of three things was called for: either to reduce the amount of white lead in the glaze, substitute an insoluble compound of lead for the carbonate employed, or to use a leadless glaze. For sanitary ware leadless glazes have answered quite satisfactorily, but manufacturers of fine china products have not taken up in a warm-hearted manner the use of leadless glazes. As regards reducing the percentage of white lead in the glaze, this was immediately necessary, for it was not uncommon at this period to find that it contained as much as 50 or 60 per cent. of white lead, an amount far in excess of the requirements of the situation. A marked reduction of the amount of lead in the glaze was called for, but it was also desirable to fix a standard of insolubility so that glazes should not yield more than 2 per cent. of lead, calculated as lead monoxide, when acted upon by a weak solution of hydrochloric acid under specified conditions. As the manufacturers considered the standard of insolubility (2 per cent.) too severe, a compromise was arranged between the Home Office and the manufacturers, 5 per cent. insolubility being subsequently agreed upon. As regards a substitute for the readily soluble white lead or carbonate, it was shown that if white lead was "fritted," *i.e.*, fired with silica or borates, a brittle glass-like material was formed which, when ground and mixed with white clay and water, would give an equally good enamelled surface to the ware and be only slightly soluble in the gastric juice of the stomach.

Since the introduction of these new methods of glazing, plumbism in the manufacture of pottery has considerably declined. In 1926 there were 41 cases of plumbism in pottery workers compared with 210 in 1900. Although the number of cases notified has diminished, the mortality rate still keeps high.

Dr. Alice Hamilton, formerly of the United States Bureau of Labour, dealing with a pottery works in America which employs 85 men as dippers, mentions the occurrence of 13 cases of lead poisoning among them, that is 1 case for every 6 male dippers. In

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IN THE STAFFORDSHIRE POTTERIES

Above : Dipping and cleaning the lead glaze on tea cups at the Royal Doulton Potteries at Burslem. *Below :* The tile pressing shop at J. H. Barratt & Company's works at Stoke-on-Trent, showing the system of exhaust ventilation.

Staffordshire the ratio is 1 in 60. As regards dippers' helpers, she found the numbers to be 13 in 180 persons employed in Trenton; in Ohio where women are employed, 29 per 150, and in East Liverpool, Ohio, while the rate among male dippers' helpers was 17, among the women it was 33, or almost double that of the male workers. Scraping-off of the excess of the glaze when dried is responsible for many cases of plumbism. In Great Britain the scraping-off is usually done when the glaze is still moist. This obviates dust and has reduced the amount of sickness among dippers' helpers.

The manufacture of earthenware and china is one of the industries to which the Home Office has given a good deal of attention. To this circumstance and to the regulations in force must be attributed the satisfactory results which have been achieved so far as the incidence of lead poisoning is concerned and the improved general health of the workers.

Here it may not be out of place to draw attention to the "Excretion of lead by persons not employed in lead industries."

It is believed that lead is probably present in the bodies of men and women not known to be connected with the lead trades. The channels by which the metal enters the body are mainly the respiratory organs and the digestive tract. The investigations which have been made by four Americans, Kehoe, Edgar, Thamann and Sanders, reveal that almost everybody is absorbing and excreting in the fæces and urine minute but yet measurable quantities of lead, and yet although this is proceeding daily no symptoms of plumbism arise. Kehoe examined the excretions of 65 men drawn from all ranks of society, including those whose occupations provided the opportunity of lead being absorbed. Some of the men examined were farmers, street sweepers and coal miners; some were employed in garages, others had worked as plumbers and painters. The fæces and urine were examined by delicate methods. The amount of lead found in the fæces were as might be expected extremely small, *e.g.*, 2 mgrms. per 100 grams of material, while in the urine the amounts of lead varied from 0.01 to 0.30 mgrm.

The dust of our streets frequently contains minute traces of lead. This is therefore a possible but unlikely source from which the metal may come. Food and drinking water may contain traces of lead. Thousands of people therefore may unknowingly be absorbing lead daily without symptoms developing, simply because elimination equals absorption, and so long as "outgo" equals "intake" no trouble arises, but should elimination by any chance become checked, the metal retained in the internal organs of the body, such as the liver, might become a cause of some of those minor complaints, for which we have no real name, and whose origin and nature we cannot always satisfactorily explain.

HIGH TEMPERATURE WORK—IRON AND STEEL TRADES

THERE are occupations in which exposure to excessive heat is unavoidable. This is particularly the case where men are employed in smelting ores, in furnace work, also when acting as stokers and firemen, or in emptying kilns in potteries. Many men bear exposure to dry heat for a short period without serious inconvenience or injurious effects, so long as the air in which the operations are carried on is circulating. It is all-important that the air should be kept in motion, particularly if dust is not raised thereby. In occupations which involve exposure to high temperatures the workmen perspire freely, a circumstance attended by loss of some of the inorganic constituents of the fluids of the body; the urine becomes concentrated, the blood is diverted from the internal organs to the skin so that digestion becomes impaired, and as the men frequently pass from an overheated to a colder atmosphere, they incur the risk of becoming chilled or of developing bronchial, pulmonary, rheumatic and kidney

affections. If to excessive heat there is added the influence of humidity the injurious effects are aggravated.

For several years past there has been a strong desire on the part of employers and employed to ameliorate the conditions of labour in the iron and steel industries. The main difficulty was that the processes are continuous. A blast furnace cannot readily be extinguished at week-ends. It is extremely expensive to re-light a blast furnace. Ways and means, however, have been found whereby in iron and steel plants conditions of labour and processes of manufacture have recently undergone alterations which have tended to lighten labour. In all modern and up-to-date plants the heaviest types of labour have been almost entirely eliminated. This circumstance has brought about a reduction in the number of men employed.

HIGH TEMPERATURE WORK
Charging an open hearth furnace employed in the manufacture of steel—an occupation involving exposure to extreme heat.

As regards the hours of labour at blast furnaces, the day is divided into three shifts of eight hours each, viz.: 6 a.m. to 2 p.m.; 2 p.m. to 10 p.m., 10 p.m. to 6 a.m. The men work these shifts in turn—in other words they change round every week.

As the work is continuous there are always some men at work on Sunday. On that day the work goes on uninterruptedly and is the same as on other days of the week. The procedure in many large plants is that on Sunday the shifts change over at 6 a.m. so as to enable each workman to have a full Sunday off every three weeks, the men of the particular set for that week-end working the "long turn" of 16 hours straight on end. In the opinion of employers and managers of large plants Sunday labour is a necessity as great as ever.

It is within the last thirty years that the working conditions for blast furnace-men and men employed in the melting shop have become improved, the one circumstance which has brought the greatest amelioration to the blast furnace-men particularly being the eight-hours day which was introduced in 1897. By the employment of mechanical appliances in their department much of the hard work has been abolished. Formerly one of the heaviest tasks was the breaking and loading of pig iron by hand labour. This is now effected by an electrically driven mechanical breaker. The iron pigs thus broken are shot down a chute into a wagon. New methods of dealing with the molten metal have also reduced the length of exposure of the men to high temperatures and incidental dangers. The slag bogies of half a century ago have been replaced by

slag ladles. The mechanical apparatus known as the "mud gun" for closing the tap hole, which was usually a hard and arduous procedure, has replaced hand labour. The mechanical charging of blast furnaces at the top has been highly successful from all points of view, while the comfort and safety of the men have been advanced by better methods of artificial lighting.

Accidents.

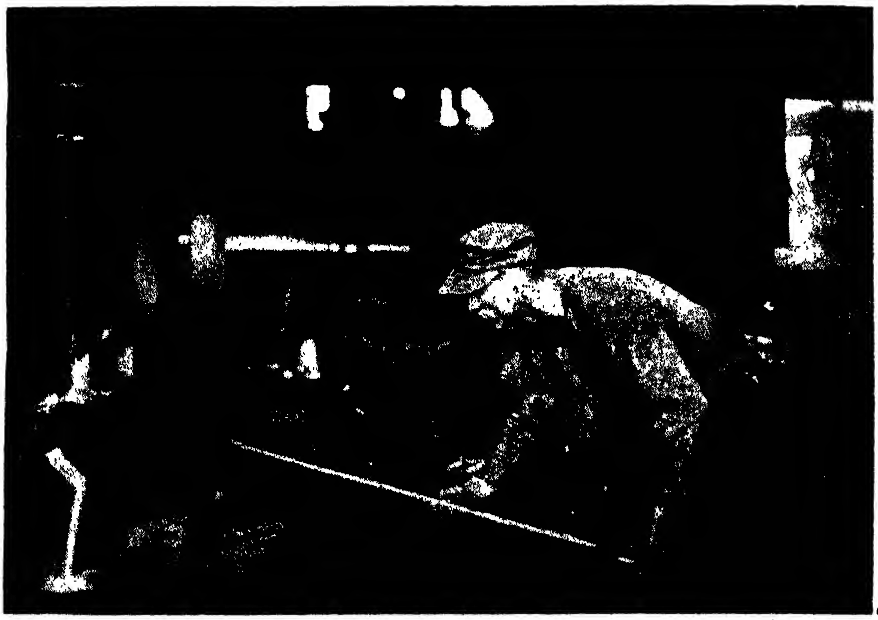
Probably more accidents occur at blast furnaces than in any other branch of the industry, owing to the men dealing with molten metal, but it is satisfactory to know that as most of the accidents are burns, experience shows that these are usually of a minor nature and therefore oblige the men to be absent from work for only a short period. Absenteeism of blast furnace-men is not higher than in other branches of the industry. Occasionally the men take days off but this is hardly to be wondered at considering the hard and continuous nature of the employment.

Although the accident rate in American iron and steel works generally is frequently as high as 240 per 1000 men employed, yet only about 1.9 per cent. of all the accidents end fatally or lead to permanent disablement. More accidents happen during the night than in day time, many of them being the result of falls, or of falling objects, burns and fractures of bones, or they are injuries to the eyes from flying sparks.

There is a little confusion between blast furnace-men and melting furnace-men. Although inter-related, their work is separate. The blast furnace-men prepare the material. When the steel trade is good there is a greater demand for pig iron; when the steel trade is bad, the call upon the blast furnaces is correspondingly less.

In rolling mills the men work eight-hour shifts. The week commences on Monday morning at 6 o'clock and terminates on Saturday at 1 p.m. The working conditions in rolling mills has been much improved. The heavy manual labour formerly associated with the rolling of molten metal for ships plates, for example, also the shearing of the glowing material has been considerably lightened by the use of machinery and the utilisation of electricity.

The demand for puddled iron has declined to such an extent that only at a few places is this method of treating iron still followed. Puddling is one of the oldest processes for purifying iron. The ore is melted in closed furnaces through the open doors of which the men, by means of a long hoe-shaped iron instrument called a "rabble," rake up the glowing liquid metal. When the iron is freed from impurities it assumes the form of a globular mass; the masses coalesce and on reaching the size of a large football they are removed. The work is well paid



[Keystone

"PUDDLING"
An occupation, now slowly disappearing, in which the work is extremely heavy and involves exposure to intense heat.

for, but it is extremely heavy. In days gone by puddlers were rather an intemperate class.

Statistics indicate that there are certain trades which invariably show a higher death-rate from pneumonia than others. To such an extent is this the case that there is suggested a causal relationship between the occupation and the high incidence of this type of disease. This applies to iron and steel workers and particularly to men employed in foundries. Among occupied males generally, the deaths from pneumonia formed 7.7 per cent., but in iron foundry workers, according to the experience of the Metropolitan Life Insurance Company of New York, the percentage was 15.9 and this for every age of the working period of life up to 64. Even in the comparatively early years, 25-34, the percentage of deaths among the men thus employed was three times the average of that of men in other occupations. It was also found that not only did iron foundry-men show the highest percentage of deaths from pneumonia, but that the malady was the cause of more deaths than any other, a circumstance not observed in other occupations.

The work conditions which contribute to the high percentage of deaths from pneumonia are dust, extreme heat, sudden variations in temperature and exposure to the weather. The returns recently published in the Decennial Report of the Registrar-General of England and Wales, 1921-23, in the main corroborate the facts just stated.

The occupations in Great Britain which show the highest death-rate from pneumonia are brass foundry labourers, steel grinders and cutlers, stevedores, cotton blow-room operatives and iron foundry furnace-men.

ELECTRICAL INJURIES AND ELECTRIC SHOCK

By the utilisation of electricity man has added considerably to the progress and amenities of civilisation. Through the opening out of new avenues of activity, and the abridgement of distance, results have been achieved undreamt of by our forbears a century and a half ago. While the electric light has illuminated the home, and the current has made cooking rapid and cleanly, and domestic management less irksome, the increasing use of electricity has brought fresh dangers into home and factory. We do not know what electricity really is, but experience has taught us to respect its power for good and harm, and how to direct and control the current. We are concerned here with the current as a menace to life.

In Great Britain, deaths from electrical shock numbered 70 between 1911-14; 99 during 1915-18; in 1924 there were 433 cases of accidents recorded of which 27 proved fatal. According to the Annual Report of the Chief Inspector of Factories and Workshops for 1926, there occurred in that year 388 electrical accidents, of which 17 were fatal, as against 414 notified during the previous year, with 24 deaths. In 1926, 32 of the accidents occurred in high tension systems in generating stations or sub-stations of authorised public supply undertakings. Most of them happened to persons cleaning or working close to live switch gear.

Death from electric shock may be instantaneous; on the body there may be no external signs of injury, or there may be burns and lacerations of the skin. Many of the accidents are the result of carelessness and ignorance, but even highly skilled workmen may be caught unawares. Live wires and unprotected switch gear are a constant source of danger. The condition of the skin of the victim, at the time of contact with live metal, and his relation to earth are important contributories to the sequel. When electrical contact is thus made the current passes not only superficially but internally as well, and irradiating itself through the nervous system it induces "shock." The effect of shock is more severe when a person is caught unexpectedly.

Many explanations have been advanced as to how electricity kills. The earliest theories came from the French school. Brouardel was of the opinion that death was caused by

stoppage of the heart; Bourrot taught that arrest of the action of the heart was consequent upon inhibition of its beat through the pneumogastric nerves, while D'Arsonval, 30 years ago, maintained that death was the result of a mechanical disruptive discharge in the tissues, or was indirectly caused by a reflex action upon the nerve centres in the medulla, especially those concerned with respiration. A few years ago, Sir Robert Bolam and myself carried out a series of experiments to ascertain the cause of death in electrical shock. The two main causes which appeared possible were arrest of the respiration and stoppage of the heart. We made use of the continuous current, having previously arranged in the anæsthetised animals to have a record simultaneously taken of the blood-pressure and the respiratory movements. By this means, we sought to ascertain how the heart and respiration became affected when currents of high potentiality were passed through the body.

Cause of Death.

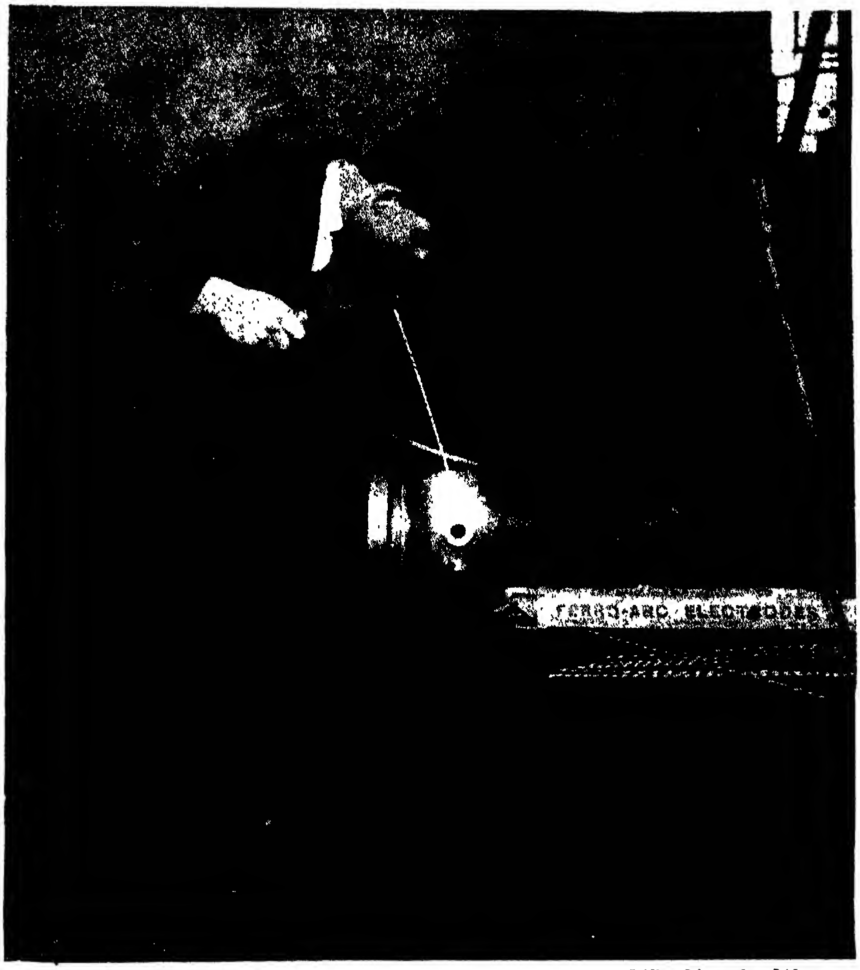
As might be expected, when electrical contact was made with the body, the muscles were thrown into a state of shortening and rigidity, breathing was suspended and there was a momentary rise of blood pressure, largely due to constriction of the peripheral arteries. On breaking contact, respiration was restored; it gradually became deeper and quicker than it was before the entrance of the current, and within a few seconds the breathing and beat of the heart became normal. In these experiments it was usually the heart which was first affected; its beating ceased and even while all cardiac movement had in some instances become entirely arrested, breathing continued. By means of artificial respiration the animals could be gradually restored to life. With the continuous current, therefore, we were convinced that, in electric shock, death is primarily of cardiac origin.

Using "alternating" and "continuous" currents Prévost and Battelli, of Geneva, about the same date, arrived at a similar conclusion. They were of the opinion that death is due to cessation of the heart's action, and that respiration may for a short period continue. They concluded that the fatal result was due to fibrillary tremor of the cardiac muscle when low voltages were employed, and to disintegration of the nervous system when high voltages were used. Since then Jellinek has followed up the subject, and his view is that death in electrical shock is the result of minute hæmorrhages and disintegrating changes in the cells of the nervous system.

E. A. Spitzka, of Philadelphia, who has had post mortem experience of criminal electrocutions in the United States, has reported that the temperature of the dead body rises to 120° F. and more within twenty minutes after electrocution. Charles A. Lauffer, of Pittsburg, U.S.A., is of the opinion that when electrical contact is made, there occur, as a consequence of the passage of the current through the body, electrolytic changes, also an accelerated metabolism whereby carbon dioxide and toxic products are formed, and that it is the excess of carbon dioxide which paralyses the respiratory centre in the medulla. Another theory is that in electrical shock there is a sudden dilatation of the large vessels in the abdominal cavity to two or three times their normal size so that as these vessels can contain enormously increased quantities of blood, respiration ceases owing to anæmia of the brain largely consequent upon the fact that little or no blood is passing through the heart.

It was formerly believed that only high tension currents caused fatal accidents, but experience has shown that even comparatively low tension currents can be followed by similar results. By the term voltage is meant pressure or tension, and by amperage, intensity. It is the intensity of the current as it traverses the body at the time of the accident which is of importance. A current of 25 milliamperes may be bearable; between 25 and 60 it can inflict considerable damage; beyond this the danger proportionally rises, so that death almost always supervenes if the intensity reaches 1000 milliamperes. In criminal electrocution the

contact is made with a high potential of 1800 volts, gradually falling to 240, the ammeter after death usually showing that 7 to 10 amperes had passed through the body.



Courtesy] [*Allen Liversidge, Ltd.*

AN ELECTRICAL WELDER AT WORK

The intense heat generated in the process is apt to cause painful burns of the eyelids and of the skin.

In death from electrical shock we usually speak of the electrical current in terms of volts. It is difficult to say what voltage is fatal to man. Under some circumstances 120 volts may cause death, yet under other circumstances 1000 volts may do no harm. Much depends upon the conditions under which the current is received. In regard to the two kinds of electrical current "continuous" and "alternating," opinions are divided as to which is the more dangerous. In Great Britain it was found during a series of years that for every three deaths caused by continuous currents, thirty were due to alternating. The British Board of Trade regarded alternating currents as twice more dangerous than continuous. Weiss is of the opinion that alternating currents are four times more dangerous than continuous, whereas Lauffeur holds that, voltages being equal, the alternating current is probably the less dangerous.

The duration of the contact is of importance, so too the direction of the current through the body. If the heart is in the path of the current, as, for example, when the current passes through the hands to the feet, the danger is increased. Moisture of the skin intensifies the effect of the contact. The dry, thickened and hardened skin of the palm of the hand of a working man offers resistance to the entrance of the current. Generally speaking the skin is a poor conductor. Mental states of the victims, such as fright and fear, add to the dangers, so too the wearing of wet boots by any person standing on moist earth or upon a metal plate. If there is fairly good contact, a low voltage current may be sufficient to throw the muscles into a state of tetanic rigidity, which not only prevents the victim breathing, but renders him unable to relax his grasp of the live material. Before he can be relieved the

circuit must be broken, and as it is when the current enters or leaves the body that effects are produced, the "making" or "breaking" of contact is a dangerous moment.

One of three things happens when a man is brought into contact with live metal: (1) he may be burnt; (2) he may be rendered unconscious and thrown into convulsions; or (3) death may be instantaneous. When contact has been made with currents of high potentiality the skin is frequently found to be charred, the wounds are irregular and usually deep, thereby exposing the underlying bone. The electrical discharge which has bridged the interval between the circuit and its victim has thus caused extensive burns, but in doing this it has considerably spent its force on the surface, and thereby the individual is saved from the more serious dangers of electric shock. In a few instances I have found large hæmorrhages in the substance of the brain.

Contact with Live Metal.

It is not uncommon for extensive superficial burns to have taken place without much pain being complained of. Pain depends upon the degree of local reactionary inflammation and upon the extent to which the sensory nerve endings have been destroyed. So also does the slowness or rapidity with which electrical wounds heal depend upon the extent to which nerve fibres have been destroyed. A current which is capable of inflicting severe wounds may, if it traverses the body, cause death. Although local effects are usually produced at the site of the entrance of the current, no local physical change may be observable, and yet injuries of such a severe nature may have been inflicted upon the deeper tissues as to oblige a surgeon subsequently to amputate the affected limb on account of deeply seated gangrene.

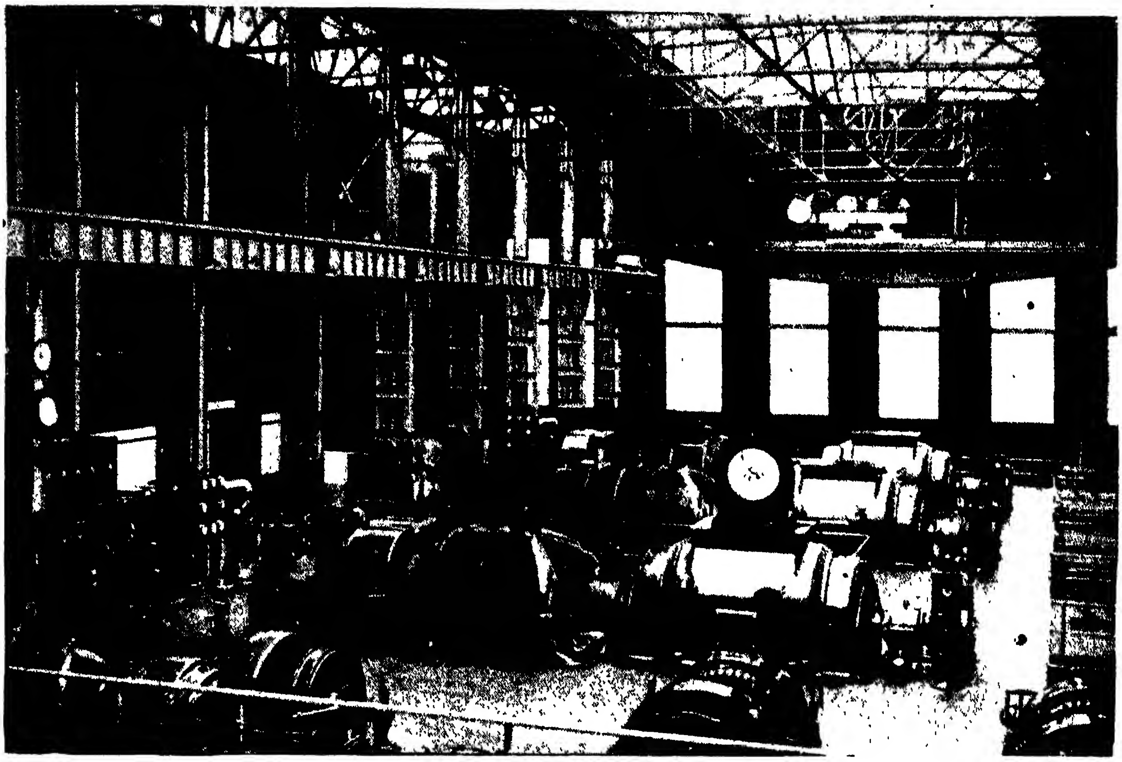
High voltage currents must be respected. Caution should be observed in approaching high voltage conductors, and a safe distance maintained between the individual and the charged metal, for arcking may occur, whereby once the air resistance has been broken, the flaming arc may carry with it an amount of current capable of inflicting serious injury.

In electrical shock many circumstances have to be considered. Allowing for moisture of skin, good contact and emotional influences, it is recognised that some persons are more susceptible than others to the harmful influences of electricity. A fatal accident may occur from contact with 120 volts, while no serious consequence may follow contact with 6000. Incidentally, as an illustration of the part the emotions play, Jellinck reports the case of a lineman who died from fright, after having touched a high voltage cable, but which at the time was not charged at all. It is difficult to explain the part fright plays in such a circumstance.

In criminal electrocution in America 10 ampere currents, as already stated, are employed, but if the electrodes are placed at the base of the skull and on the calves of the legs one-tenth ampere may kill when contact with low voltages is maintained for a fair length of time. Once the skin resistance has become reduced, a current at first capable of doing harm locally may become additionally dangerous by securing for itself an internal path. Although electrical burns shortly after their incidence look serious, yet it is astonishing the rapidity with which some of them heal: the reverse is equally true.

We have dealt with the serious injuries which electricity is capable of causing, but does the repeated exposure of workmen to high tension currents in generating and transforming stations produce physical changes in their bodies? Years ago Jellinck drew attention to rigidity of the temporal and radial arteries of men employed in generating stations. Of 80 workmen examined, 20 were found whose radial arteries had become tortuous and as hard as a quill, also whose temporal arteries showed similar changes. The tendon reflexes were exaggerated and there were indications here and there on the limbs of limited areas of periostitis. Older workmen are prone to

Repeated Exposures.



[Topical

A MODERN ELECTRIC POWER STATION

The source of the heavy electric currents for transport and lighting which must be handled with knowledge and care if accidents are to be avoided.

become more nervous than men of their own age in other occupations.

In men employed in testing arc lamps and adjusting carbon pencils, inflammation of the eyelids or harmful effects upon the iris and retina may be produced, if coloured glass spectacles are not worn. The pain in the eyelids and in the conjunctival covering of the front of the eyeball is usually severe; there are also aversion to light and a copious secretion of tears. In the welding of metals the intense heat generated causes painful burns of the eyelids and of the skin; frequently the burns do not reveal themselves until several hours after the men have left work. Dr. B. Harrison, of Sydney, has reported that in Australia cataract is not infrequently met with in men who have followed the occupation of electrical welding.

In death from electrical shock the muscles, hours afterwards, are still rigid; the body may be pale or livid and there may or may not be external signs of burning. Internally the abdominal veins are usually filled with dark liquid blood and the organs are congested. The right side of the heart is flaccid, and the left firm and somewhat contracted. The blood is not, as a rule, coagulated, although occasionally it has been found thus. Beyond a few minute hæmorrhages on the surface, and a varying degree of congestion internally, the lungs exhibit no special feature. Usually the pupils are dilated, and in the substance of the brain hæmorrhages of varying size are seen.

Wherever electricity is used on a large scale for lighting, transport or welding purposes, the men who are likely to be brought into contact with the current ought to be carefully instructed as to dangers and how to obviate them. There are certain types of bodily constitution which explain why some persons are more readily affected by electricity than others, but just what that type of constitution is, it is difficult to say, also whether it could

Prevention of Accidents.

be detected by medical examination before commencing work. Persons who are highly strung, and are of a nervous disposition, whose skin is moist and perspires readily, are not good subjects for electrical work.

Allowing for accidents which cannot always be foreseen, there is not the least doubt that many of the mishaps are the result of ignorance or carelessness. Where men are dealing with cables it is absolutely necessary that not only should the current be cut off before work is commenced, but that the utmost care should be taken to see that no current is turned on until it is known that the men have ceased work and retired. Only intelligent men should be employed in dangerous areas; they should receive instruction and practical training in regard to accidents and how these may be prevented. When electrical contact is made with the human body the voltage may be so high as to throw the muscles into a condition of rigidity whereby the individual is unable to liberate himself. There ought therefore to be close at hand a circuit-breaker by means of which the current can be immediately cut off.

In the absence of such equipment, a would-be rescuer knowing the risks which he himself, if unprotected, would incur by handling a colleague thus entangled, ought by means of a piece of dry wood to push or cause to roll aside the body from the live metal. Standing on dry wood, or on a dry concrete floor, and with his hands wrapped round in several layers of dry cloth, the rescuer might possibly be able to pull upon the dry clothing of his comrade and thus detach him, or he might try to short circuit the line by throwing a piece of metal across the two conductors of the current. This would either break or open the circuit, or blow the fuses which protect that part of the electric system. A metal bar or piece of piping thus placed would offer a more direct electrical path for the current than that through the body of the victim. But even in attempting this, there is need for caution. Electrical accidents are instantaneous, and while they call for immediate efforts of rescue, only trained men should undertake the task, for the work must be done calmly and in an intelligent manner.

Workmen should be provided with thick india-rubber gloves and with insulated spanners. If these are unattainable, then, as already stated, the hands of the rescuers should be wrapped in thick dry clothing, so that they themselves may not receive a shock. By means of long shears with wooden handles wires may be cut.

Once the injured workman has been liberated, artificial respiration should without delay be commenced and continued for an hour and more, for in electrical shock death is only apparent, and in many instances can by means of artificial respiration be recovered from. The absence of the pulse at the wrist is no criterion of death, for while the beat of the heart may not be felt the organ may still be contracting feebly, so that not only will artificial respiration amplify the beats of the heart, but stimulate both breathing and circulation. On no account should brandy or whisky be introduced into the mouth. Twice when carrying out our experiments, Bolam and Oliver succeeded in resuscitating an animal whose heart had ceased beating for 8 and 13 minutes, respectively. Nor is cardiac fibrillary tremor always an indication that recovery is impossible. What is imperative is that artificial respiration, once the victim is freed, should be commenced immediately, and persistently pursued in a physiological manner by relays of men, for all the while the blood is becoming more and more surcharged with carbon dioxide and death is impending from asphyxia.*

Restorative Treatment.

When the man is breathing naturally he can be taken into the fresh air or near an open window, but must be kept warm. Hot-water bottles should be applied to the feet and to the heart region to stimulate the circulation, taking care not to burn the patient, and his limbs should be rubbed towards the heart. Alcoholic stimulants must be avoided, but a drink of hot coffee can be given when respiration is thoroughly restored.

* See Artificial Respiration, *page* 1151.

MEDICINES IN COMMON USE

MEDICINES or drugs are chemical substances used for their specific effects on the various tissues of the human body. Some are applied for their *local action* on the skin or mucous membranes, while others are given by the mouth in order to elicit a *general action* after their absorption.

The effects of drugs on human beings are subject to the size of the dose, which must be altered to take into account size, weight, age, sex and special conditions of health.

Large persons require a slightly larger dose than a person of ordinary size, while a small person requires a reduced dose.

Children must receive much smaller doses than adults. The dose is generally calculated according to Young's formula, in which a fraction, obtained by dividing the age of the child by the age plus 12, gives the proportion of the adult dose required; thus for a child of six, the dose would be $\frac{6}{6+12} = \frac{1}{3}$ of the adult dose. In *very old people* also, the dose requires to be reduced.

Women generally require smaller doses than men. During pregnancy and menstruation purgatives must be used with care.

Drugs when taken needlessly or to excess are poisons, and reckless self-drugging is definitely a menace to health. It is therefore important that the public should be **educated to an appreciation of the action and use of drugs in order that co-operation with the doctor in charge of treatment may be closer, and it is with this object that the following prescriptions are given.**

MEDICINES FOR EXTERNAL USE

LOTIONS

ANTISEPTIC.

(1) Boracic Acid.

This is used in the strength of one teaspoonful to a tumbler of warm water for application to cuts and abrasions, for syringing the ear or nose, and for bathing the eyes.

(2) Liq. Hydrogen Peroxide.

A useful lotion for many purposes.

(3) Carbolic Acid Lotion, 1 in 40.

(4) *Red Lotion.* (Useful to stimulate sluggishly healing tissues.)

Zinc Sulphate	- -	5 grains.
Tincture of Lavender	-	5 minims.
Water	- - to	1 ounce.

SOOTHING LOTION.

For sunburn or other mild forms of skin irritation.

Calamine	- -	10 grains.
Zinc Oxide	- -	10 grains.
Glycerine	- -	30 minims.
Lime Water	- -	3 drachms.
Distilled Water	to	1 ounce.

To be applied frequently to the skin with a brush.

EVAPORATING LOTION.

For local application to sprained joints, tendons, etc.; acute gout, insect bites and stings.

Liquor Ammonium Acetate		2 ounces.
Methylated Spirit	-	2 ounces.
Water	- - to	10 ounces.

To be applied on lint without being covered with oil-silk.

HEAD LOTIONS.

(1) For use in dirty heads - infection with pediculi capitis (head louse).

Kerosene	- - -	2 ounces.
Olive Oil	- - -	1 drachm.

N.B.—Care to be taken that the application of this lotion is carried out away from any naked lights.

(2) For cleansing head from Seborrhœa.

Saponis Viridis (Green Soap)	- - -	1 ounce.
Spirits of Wine	- -	3 ounces.
Oil of Lavender	- -	15 minims.

THROAT PAINTS

(1) *Mandl's Paint.*

Iodine - - -	5 grains.
Potassium Iodide -	20 grains.
Oil of Peppermint -	5 minims.
Glycerine - - to	1 ounce.

To be applied to throat with a soft hair brush every four hours.

(2) Glycerine Acid Carbolic.

To be used as a paint in painful and septic throat affections.

(3) Glycerine Acid Tannic.

To be used as a paint in chronic pharyngitis.

(4) Glycerine and Borax.

To be used as a paint in throat affections in children.

(5) Tincture of Iodine (Weak).

To be used as a paint in Vincent's angina.

(6)

Silver Nitrate - -	3 grains.
Water - - to	1 ounce.

To be used as a paint in chronic pharyngitis.

or (7)

Zinc Chloride - -	5 grains.
Water - - to	1 ounce.

INHALATIONS

(1)

Creosote - - -	1 drachm.
Compound Tincture of Benzoin - - to	1 ounce.

One teaspoonful in a pint of hot steaming water. To be inhaled in inflammatory conditions of the air-passages.

(2)

Spirit of Menthol - -	1 drachm.
Spirit of Camphor -	1 drachm.
Compound Tincture of Benzoin - - to	1 ounce.

One teaspoonful in a pint of hot water. To be inhaled.

(3) *Smelling Salts.*

Ammonium Carbonate	1 ounce.
Oil of Lavender - -	20 minims.
Acid Carbolic - -	10 grains.
Compound Tincture of Benzoin - - -	½ ounce.

A dry inhalation for catarrh.

INHALATIONS FOR FOETID BRONCHITIS

(1)

Carbolic Acid - -	½ drachm.
Compound Tincture of Camphor - -	2 ounces.

A teaspoonful to be inhaled freely from the steam of half a pint of hot water.

or (2)

Thymol - - -	1 drachm.
Carbolic Acid - -	2 drachms.
Creosote - - -	2 drachms.
Spirit of Chloroform -	1 ounce.

To be inhaled.

SPRAYS FOR NOSE AND THROAT

(1)

Liq. Formaldehyde -	5 minims.
Glycerine - - -	½ ounce.
Water - - to	1 ounce.

To be used as an antiseptic spray in purulent conditions of the nose or throat.

(2)

Menthol - - -	5 grains.
Oil of Eucalyptus -	5 minims.
Liq. Paraffin - to	1 ounce.

To be used as a sedative spray in acute nasal catarrh with obstruction.

NOSE WASHES

(1)

Sodium Chloride	½ drachm.
Sodium Bicarbonate	½ drachm.
Sodium Biborate	½ drachm.
Water - - to	8 ounces.

Two tablespoonfuls to be mixed with equal quantity of warm water and used with an irrigator or douche. A simple alkaline lotion.

(2)

Sodium Biborate - -	½ drachm.
Rectified Spirit - -	2 drachms.
Glycerine - - -	3 drachms.
Water - - to	8 ounces.

To be used with equal quantity of warm water. A mild astringent lotion.

MOUTH WASHES (GARGLES)

(1) Liq. Potassium Permanganate (*Condy's Fluid*).

A few drops in a tumblerful of warm water, and used as a gargle.

(2) Potassium Chlorate - 2 drachms.
Water - - to 8 ounces.

To be mixed with an equal quantity of warm water and used as a gargle. Valuable in acute pharyngitis.

(3) Salicylic Acid - - ½ drachm.
Rectified Spirit - - 3 drachms.
Camphorated Water to 8 ounces.

To be used as a gargle.

(4) Tincture of Myrrh - 4 drachms.
Tincture of Cinchona - 4 drachms.
Eau de Cologne - - 1 ounce.

A small teaspoonful in a wineglassful of water, as a mouth wash for spongy gums.

(5) Alum - - - 4 drachms.
Tannic Acid - - 1 drachm.
Rose Water - to 8 ounces.

To be used as an astringent gargle for relaxed throat.

(6) Glycerine Acid Carbolic 3 drachms.
Tannic Acid - - 2 drachms.
Tincture of Capsicum - 1 drachm.
Rose Water - to 12 ounces.

To be used as a gargle in chronic pharyngitis.

(7) Ammonium Bromide - 2 drachms.
Glycerine Acid Carbolic 4 drachms.
Rose Water - to 10 ounces.

To be used as a gargle in irritable throats.

LINIMENTS AND EMBROCATIONS

For Use in Sprains and Painful Muscle Conditions.

Liniment of Soap.

Soft Soap - 2 ounces.
Camphor - 1 ounce.
Oil of Rosemary - 3 fl. drachms.
Alcohol 90% - 16 fl. ounces.
Distilled Water - 4 fl. ounces.

Dissolve the soap in the distilled water; dissolve the camphor and oil of rosemary in the alcohol; mix the solutions together. Set aside for one week; filter.

Liniment of Mustard.

Volatile Oil of Mustard 1½ fl. drachms
Camphor - - 120 grains.
Castor Oil - - 5 fl. drachms.
Alcohol 90% - 4 fl. ounces.

Dissolve the camphor in the alcohol; add the oil of mustard and castor oil; mix.

Liniment of Turpentine.

Soft Soap - - 1½ fl. ounces.
Distilled Water - 5 fl. ounces.
Camphor - - 1 ounce.
Oil of Turpentine 13 fl. ounces.

Mix the soft soap with 2 fluid ounces of the distilled water; dissolve the camphor in the oil of turpentine; gradually add the latter solution to the former, triturating until the mixture becomes a thick creamy emulsion; lastly mix with sufficient distilled water to produce 1 pint.

For Use in Neuralgia.

(1) Menthol - - - 8 parts.
Olive Oil - - - 10 parts.

To be applied over the painful area.

(2) *Dental Neuralgia.*

Creosote (pure) - - ½ drachm.
Compound Tincture of Benzoin - - - 1 drachm.

To be applied to the cavity of the tooth on cotton wool.

OINTMENTS

(1) Boric Acid Ointment.*—A simple preparation used in mild inflammatory conditions of the skin or mucous membranes.

* Preparations marked thus are standardised according to the British Pharmacopœia and are stocked in prepared form by the Chemist.

(2) Carbolic Acid Ointment.*—A more powerful antiseptic than the above.

(3) Salicylic Acid Ointment.*—A preparation, mildly antiseptic but useful in removing scales and crusts from the skin, *e.g.*, in psoriasis or seborrhœa.

(4) Rose Water Ointment * (*Cold Cream*).—A pleasant preparation for dry skin or to protect the skin from the effects of harsh weather.

(5) Capsicum Ointment.*—A counter-irritant, used to produce heat and warmth and so reduce pain in deep inflammatory conditions, *e.g.*, Bronchitis.

(6) Eucalyptus Ointment.*—A mild antiseptic ointment used for lip cracks and broken chilblains.

(7) Gall Ointment.*—An astringent preparation used in the treatment of piles or hæmorrhoids.

(8) Lead Subacetate Ointment.*—An ointment used to relieve the pain of sprains and other joint affections.

(9) Mercury Ointment * (*Blue Ointment*).—A highly antiseptic preparation used in the local treatment of syphilis, also as a prophylactic.

(10) Ammoniated Mercury Ointment.*—An antiseptic preparation used in eczema and seborrhœa.

(11) Iodine Ointment.*—An antiseptic ointment for general purposes—of use specially in rheumatic joint inflammation.

(12) Resin Ointment.*—A pleasant antiseptic and soothing ointment used in inflammatory skin affections where there is itching.

(13) Zinc Ointment.*—A mildly astringent ointment useful to protect the skin, and to soothe slight skin inflammation.

DROPS FOR THE EAR

(1) Sodium Bicarbonate - 10 grains.
Glycerine - - - ½ ounce.
Water - - - to 1 ounce.

To be used to soften a collection of wax in the ear before syringing. Half a teaspoonful to be dropped warm into the ear three or four times a day.

(2) Acid Carbolic Liq. - 15 minims.
Glycerine - - to 1 ounce.

To be used warm in earache.

(3) Liq. Hydrogen Peroxide.

To be used to soften wax in ear before syringing; in boils of the external opening of the ear; and in treatment of middle-ear suppuration.

(4) Mercury Perchloride - 1 grain.
Rectified Spirit - - 1 ounce.
Water - - - to 4 ounces.

To be used to reduce granulation in ear following middle-ear disease.

* Preparations marked thus are standardised according to the British Pharmacopœia and are stocked in prepared form by the Chemist.

MEDICINES FOR INTERNAL USE

DYSPEPSIA (INDIGESTION)

ATONIC DYSPEPSIA.

To promote the functional activity of the muscular coat of the stomach and the secreting glands.

(1) Sodium Bicarbonate - 15 grains.
Tincture of Nux Vomica 15 minims.
Aromatic Spirits of
Ammonia - - - 30 minims.
Compound Infusion of
Orange - - to 1 ounce.

Two tablespoonfuls of the mixture to be taken three times daily, half an hour before meals.

or (2) Tincture of Nux Vomica 15 minims.
Pepsin - - - - 3 grains.
Dilute Hydrochloric Acid 10 minims.
Tincture of Capsicum - 3 minims.
Compound Infusion of
Orange - - to 1 ounce.

Two tablespoonfuls of the mixture to be taken three times daily immediately after meals

To relieve eructations and flatulent distension.

(1) Tincture of Rhubarb - 1 drachm.
Sodium Bicarbonate - 15 grains.
Magnesium Carbonate - 10 grains.
Aromatic Spirits of Ammonia - - - 30 minims.
Chloroform Water to 1 ounce.

A tablespoonful to be taken as occasion arises.

or (2) A powder made up of 5 grains of powdered charcoal with 5 grains of bismuth carbonate—to be taken immediately before or after meals according to the period when the flatulence is most complained of.

ACID DYSPEPSIA.

(1) An efficacious remedy for excessive formation of acid towards the end of stomach digestion is the taking of a tumblerful of hot water in which are dissolved a few grains of bicarbonate of soda or of magnesia.

or (2) Magnesia - - - - 2 grains.
Bismuth Subnitrate - 5 grains.

A powder to be taken before eating.

DYSPEPSIA DUE TO SLUGGISH INTESTINAL FUNCTION.

Sodium Bicarbonate - - 15 grains.
Sodium Chloride - - 5 grains.
Sodium Sulphate - - 30 grains.
Magnesium Sulphate - - 1 drachm.
Peppermint Water - to 1 ounce.

Two tablespoonfuls to be taken every morning.

ACUTE GASTRIC CATARRH.

(1) *In Adults.*

Bismuth Salicylate - 25 grains.
Dilute Hydrocyanic Acid 15 minims.
Sodium Bicarbonate - 1 drachm.
Mucilage of Tragacanth 1 ounce.
Water - - - to 6 ounces.

Two tablespoonfuls every three or four hours.

(2) *In Children.*

Bismuth Carbonate - 2 grains.
Sodium Bicarbonate - 2 grains.
Rhubarb Powder - - ½ grain.
Aromatic Powdered Chalk 1 grain.

One such powder to be taken before each meal.

CHRONIC GASTRIC CATARRH.

(1) Bismuth Carbonate - 10 grains.
Dilute Hydrocyanic Acid 5 minims.
Mucilage of Tragacanth 1 drachm.
Peppermint Water to 1 ounce.

Two tablespoonfuls to be taken half an hour before food when in pain.

(2) *If associated with Anæmia.*

Iron and Quinine Citrate 5 grains.
Dilute Hydrochloric Acid 10 minims.
Water - - - to 1 ounce.

To be taken after food three times a day.

(3) *In Children.*

Sodium Bicarbonate - 1 drachm.
Creosote (Pure) - - 4 minims.
Glycerine - - - 2 drachms.
Oil of Cinnamon - - 4 minims.
Distilled Water - to 4 ounces.

A small teaspoonful in a little water, shortly after meals.

GASTRIC ULCER.

(1) Bismuth Carbonate - 15 grains.
Magnesium Carbonate - 15 grains.
Sodium Bicarbonate - 5 grains.
Mucilage of Tragacanth 1 drachm.
Water - - - to 1 ounce.

Two tablespoonfuls to be taken some time before food three times a day.

(2) *With Flatulent Dyspepsia.*

Potassium Iodide - - 6 grains.
Potassium Bicarbonate - 1 drachm.
Tincture of Orange - 2 drachms.
Infusion of Gentian to 6 ounces.

Two tablespoonfuls one hour after food.

INTESTINAL COLIC.

(1) *In Adults.*

Powdered Rhubarb ½ drachm.
Tincture of Rhubarb 3 drachms.

Magnesium Carbonate		1 drachm.
Spirit of Peppermint	-	1 drachm.
Water - - -	to	6 ounces.

One tablespoonful to be taken thrice daily.

(2) *Colic in Children.*

Aromatic Spirits of Ammonia - -	-	10 minims.
Magnesium Carbonate	-	20 grains.
Simple Syrup -	-	1 drachm.
Water - - -	to	2 ounces.

One or two teaspoonfuls every three hours.

(3) *Flatulent Colic.*

Compound Tincture of Cardamons -	-	15 minims.
Chloroform Water	to	2 drachms.

Two teaspoonfuls every hour in water.

or (4) Turpentine Enema for Flatulent Colic, *see* "Care of the Invalid," p. 1070.

CONSTIPATION

OCCASIONAL CONSTIPATION.

(1) *In Adults.*

Calomel, 2 to 3 grains at night, followed by a seidlitz powder in the morning.

or (2) Phenophthalein 2 to 4 grains, to be followed by a saline draught in the morning.

(3) *In Children.*

Castor Oil - -	-	1 drachm.
Syrup of Lemon -	-	2 drachms.
Mucilage of Acacia	to	1 ounce.

Two tablespoonfuls to be taken.

HABITUAL CONSTIPATION.

(1) *In Adults.*

Liquid Extract of Cascara		2 ounces.
Tincture of Nux Vomica		3 drachms.
Glycerine - -	to	4 ounces.

One teaspoonful night and morning for four days, and then only at night.

or (2)

Iron Sulphate	-	15 grains.
Magnesium Sulphate	-	1 ounce.
Quinine Sulphate -	-	10 grains.
Dilute Sulphuric Acid	-	30 minims.
Water - - -	-	8 ounces.

One tablespoonful twice a day, an hour before breakfast and dinner. A useful prescription for constipation and anæmia in women.

(4) *In Children.*

Sodium Phosphate, 10-20 grains in milk daily.

or (5)

Liquid Extract of Cascara		6 drachms.
Tincture of Nux Vomica		½ drachm.
Compound Tincture of Gentian - -	-	6 drachms.

Two drops in a teaspoonful of water three times daily one hour after meals.

PILLS FOR CONSTIPATION.

(1)

Extract of Aloes -	-	2 grains.
Extract of Belladonna	-	⅛ grain.

One pill to be taken every night.

or (2) Compound Colocynth Pill.
One or two to be taken at night.

DIARRHŒA

WHEN DUE TO AN IRRITANT.

(1)

Castor Oil - -	-	6 drachms.
Compound Tragacanth Powder - -	-	1 drachm.
Syrup - - -	-	4 drachms.
Water - -	to	3 ounces.

A tablespoonful every hour or two until relieved. A smaller dose, one to two teaspoonfuls, to be given in the case of children.

or (2) Compound Rhubarb Powder (*Gregory's Powder*) is excellent in children in doses of 5 to 20 grains.

(3) *For a very young child* the following is a useful formula :—

Compound Kino Powder		1 grain.
Aromatic Powdered Chalk		4 grains.
Sodium Bicarbonate	-	2 grains.

The powder to be given in a teaspoonful of arrowroot every three or four hours until relieved.

Diarrhœa in Adults (Intestinal Catarrh)

Aromatic Powdered Chalk	120 grains.
Sodium Bicarbonate	40 grains.
Mucilage of Tragacanth	2 ounces.
Chloroform Water to	8 ounces.

Two tablespoonfuls every four hours.

Chronic Diarrhœa.

(1) *In Adults.*

Zinc Oxide - - -	6 grains.
Prepared Chalk - -	2 grains.

Mucilage—as much as necessary to make two pills.

One pill to be taken thrice daily.

(2) *In Children.*

Iron Sulphate - -	10 grains.
Sodium Salicylate -	20 grains.
Glycerine - - -	3 ounces.
Water - - - to	6 ounces.

(*Note.*—The Iron Sulphate and Sodium Salicylate to be dissolved separately and then mixed.)

One tablespoonful every two hours until the stools are blackened.

INTESTINAL ANTISEPTIC POWDER

Salol - - - - -	5 grains.
Bismuth Salicylate -	5 grains.
Sodium Bicarbonate -	5 grains.

The powder to be taken before food twice or thrice daily.

DYSENTERY

A teaspoonful of a saturated solution of Magnesium Sulphate to be given every hour until the characteristic symptoms disappear.

Astringent Pills in Dysentery.

Silver Nitrate - -	½ grain.
Powdered Ipecacuanhæ	3 grains.

A pill to be taken every eight hours.

Enemata in Dysentery.

Various antiseptic and astringent substances are used in enemata.

(1) Bichloride of Mercury, daily injection of 1 ounce of a 1-in-5000 solution.

or (2) Alum ½ ounce to ½ pint of water, twice daily.

or (3) Silver Nitrate 5 grains to 5 ounces: to make four enemata; two to be given daily.

Suppositories in Dysentery.

Tannic Acid - -	- 15 grains.
Oil of Theobroma	- 2½ drachms.

To make four suppositories. One to be used daily after motion of bowels.

INTESTINAL PARASITES

For Tapeworm.

Liquid Extract of Male Fern in 15-grain capsules.

A capsule to be taken every quarter of an hour till four have been taken. After two hours a purgative (tablespoonful of castor oil) is necessary.

For Round Worm.

(1) Santorin in 2 to 3-grain doses is given after a mild fast and purge and followed by a purge. This drug is to be used with great caution in young children and infants.

(2) A useful formula:

Santorin - - -	2 grains.
Castor Oil - - -	2 drachms.
Syrup of Orange - -	1 drachm.
Mucilage of Acacia -	3 drachms.
Water - - - to	3 ounces.

Take in the morning fasting.

For Threadworms.

An enema containing infusion of quassia is the best treatment and reappearance of the worms is prevented by the following mixture:

Tincture of Rhubarb -	3 minims.
Magnesium Carbonate -	3 grains.
Tincture of Ginger -	1 minim.
Water - - - to	1 drachm.

One teaspoonful thrice daily.

BRONCHITIS

ACUTE BRONCHITIS.

(1) *In Children.*

Ipecacuanhæ Wine -	1 drachm.
Liquor of Ammonium Acetate - - -	2 drachms.
Syrup of Tolu - -	4 drachms.
Water - - - to	2 ounces.

A teaspoonful every two hours for a child of two years old.

(2) *In Adults.*

Ammonium Chloride -	30 grains.
Syrup of Senega - -	6 drachms.
Infusion of Gentian -	8 ounces.

One tablespoonful every four hours.

(3) *When the Expectoration is Sticky and Difficult to Expel.*

Potassium Iodide - -	40 grains.
Ammonium Carbonate	40 grains.
Sodium Bicarbonate -	20 grains.
Tincture of Senega -	4 drachms.
Chloroform Water to	8 ounces.

Two tablespoonfuls with two of hot water, thrice daily.

CHRONIC BRONCHITIS.

(1)

Ammonium Carbonate	24 grains.
Tincture of Squills -	2 drachms.
Compound Tincture of Camphor - - -	2 drachms.
Infusion of Senega to	8 ounces.

One tablespoonful every three hours.

(2) *For "Dry" Chronic Bronchial Catarrh.*

Potassium Iodide - -	½ drachm.
Potassium Bicarbonate -	½ ounce.
Ammonium Chloride -	2 drachms.
Chloroform Water to	8 ounces.

One tablespoonful every four to six hours.

(3) *Pill for Chronic Bronchial Catarrh.*

Creosote - - -	12 minims.
Powdered Soap - -	15 grains.
Bread - - - - -	½ drachm.

Make twelve pills: one pill to be taken thrice daily.

RHEUMATIC BRONCHITIS.

Sodium Salicylate -	6 drachms.
Glycerine - - -	½ ounce.
Compound Syrup of Squills - - -	2 ounces.
Compound Tincture of Camphor - - -	2 ounces.

A teaspoonful of the mixture every three or four hours.

ASTHMA

Powders to Burn.

Lobelia, powdered -	of each 1 ounce.
Black Tea, powdered -	
Stramonium Leaves, powdered - - -	

Pour upon this mixture 2 ounces of a saturated solution of nitrate of potash, mix thoroughly and dry.

During Paroxysms and in the Intervals.

(1)

Potassium Iodide - -	5 grains.
Extract of Stramonium -	⅛ grain.
Aromatic Spirits of Ammonium - -	10 minims.
Chloroform Water to	1½ ounces.

This draught to be taken at bedtime.

or (2)

Chloral Hydrate - -	20 grains.
Potassium Iodide - -	15 grains.
Syrup - - - -	½ ounce.
Water - - - to	4 ounces.

One tablespoonful every two hours.

COLD IN THE HEAD (CORYZA)

Aspirin - - - -	5 grains.
Phenacetin - - -	5 grains.
Dover's Powder - -	5 grains.

This powder to be taken last thing at night, preferably followed by a warm drink.

ANAEMIA (BLOODLESSNESS)

IN GIRLS (GREEN SICKNESS).

(1)

Iron Sulphate - -	24 grains.
Magnesium Sulphate -	6 drachms.
Aromatic Sulphuric Acid	1 drachm.
Tincture of Ginger -	2 drachms.
Infusion of Gentian to	8 ounces.

One tablespoonful thrice daily (after meals).

(2) *Aperient Iron Pills.*

Iron Sulphate	-	20 grains.
Potassium Carbonate		20 grains.
Powdered Myrrh	-	1 drachm.
Extract of Aloes	-	½ drachm.

Make 30 pills. One thrice daily after meals.

PALPITATIONS

If Associated with Gastric Catarrh.

Bismuth Carbonate	-	10 grains.
Sodium Bicarbonate	-	5 grains.
Tincture of Cinchona	-	5 minims.
Water - - -	to	1 ounce.

Two tablespoonfuls to be taken one hour before food.

VOMITING OF PREGNANCY (MORNING SICKNESS)

Sodium Bromide -	-	5 grains.
Chloral Hydrate -	-	5 grains.
Chloroform Water	to	½ ounce.

One tablespoonful twice or thrice daily.

JAUNDICE

When due to extension of catarrh from stomach or duodenum.

(1)

Extract of Aloes -	-	½ drachm.
Sodium Bicarbonate	-	1 drachm.

Syrup as necessary to make 30 pills

One to be taken night and morning.

or (2)

Sodium Bicarbonate	-	1 ounce.
Powdered Rhubarb	-	2 drachms.
Powdered Ginger -	-	2 drachms.
Dover's Powder -	-	1 drachm.

Make powder ; a small teaspoonful in water every four to six hours.

CONGESTION OF THE LIVER

(1)

Sodium Bicarbonate	-	3 drachms.
Ammonium Carbonate		½ ounce.
Water - - -	to	6 ounces.

and

Citric Acid - - -	-	1½ drachms.
Syrup of Lemon -	-	6 drachms.
Water - - -	to	6 ounces.

Two tablespoonfuls of each mixture to be mixed together and drunk while effervescing an hour before meals.

or (2)

Ammonium Chloride	-	½ ounce.
Peppermint Water	-	4 ounces.

A dessertspoonful thrice daily.

(3) *Purgative Pills.*

Powdered Rhubarb	-	2 drachms.
Extract of Aloes -	-	30 grains.
Extract of Colocynth	-	6 grains.

Extract of Rhubarb as necessary to make 60 pills.

Two pills to be taken twice daily.

NEURALGIA

Aspirin - - - -	-	5 grains.
Phenacetin - -	-	5 grains.
Caffein - - -	-	1 grain.

The powder to be taken not more often than thrice daily.

TRIGEMINAL NEURALGIA (TIC).

Chloral Hydrate -	-	10 grains.
Tincture of Gelsemium		15 minims.
Chloroform Water	to	½ ounce.

One tablespoonful thrice daily.

RHEUMATIC NEURALGIAS.

Phenacetin - -	-	40 grains.
Salol - - -	-	40 grains.
Caffein - - -	-	4 grains.

Divide into 10 cachets. Two to four daily.

HEADACHE

MIGRAINE (SICK HEADACHE).

Phenacetin - -	-	10 grains.
Caffein - - -	-	2 grains.

The powder to be taken twice daily if necessary.

ANÆMIC HEADACHE.

Ammonium Bromide	-	1 ounce.
Mucilage of Acacia	-	4 ounces.
Spirit of Peppermint	-	1 drachm.

One teaspoonful in water twice daily.

NERVOUS HEADACHE.

Tincture of Hyoscyamus ½ ounce.
Aromatic Spirits of Ammonia - - - ½ ounce.
Syrup of Orange - - 1 ounce.
Peppermint Water - 2 ounces.

One tablespoonful for a dose.

INSOMNIA (SLEEPLESSNESS)

INSOMNIA WITH DYSPEPSIA.

Sodium Bicarbonate - 20 grains.
Aromatic Spirits of Ammonia - - - ½ drachm.
Peppermint Water to 1½ ounces.

To be taken at bedtime with an equal quantity of warm water.

INSOMNIA WITH MENTAL EXCITEMENT.

Chloral Hydrate - - 10 grains.
Paraldehyde - - - 1 drachm.
Syrup - - - - 1 drachm.
Water - - - to 1 drachm.

The draught to be taken at bedtime.

EPILEPSY

(1) Ammonium Bromide -
Sodium Bromide -
Potassium Bromide - } of each 2½ drachms.
Water - - - to 8 ounces.

One tablespoonful thrice daily.

or (2) Antipyrine - - - 2 drachms.
Ammonium Bromide - 4 drachms.
Cinnamon Water - - 3 ounces.

One teaspoonful thrice daily.

RHEUMATISM

ACUTE RHEUMATISM.

Sodium Salicylate - 3 drachms.
Sodium Bicarbonate - 1 drachm.
Syrup (Simple) - - 1 ounce.
Water - - - to 6 ounces.

One tablespoonful every four hours.

CHRONIC RHEUMATISM.

Sodium Iodide - - 2 drachms.
Sodium Bicarbonate - 4 drachms.
Liquor Arsenicalis - 1½ drachms.
Chloroform Water - 20 ounces.

One tablespoonful in water thrice daily after meals.

MUSCULAR RHEUMATISM (LUMBAGO, ETC.).

Sodium Salicylate - 3 drachms.
Sodium Iodide - - 1 drachm.
Syrup (Simple) - - 1 ounce.
Water - - - to 8 ounces.

One tablespoonful thrice daily.

NEURITIS

Antipyrine - - - 1½ drachms.
Potassium Bromide - 4 drachms.
Camphor Water - to 8 ounces.

One tablespoonful morning and evening.

CHRONIC GOUT

Potassium Iodide - - 2 drachms.
Potassium Bicarbonate - 6 drachms.
Colchicum Wine - - 2 drachms.
Camphor Water - - 12 ounces.

One tablespoonful thrice daily after meals.

INFLUENZA

(1) *Fever.*

Compound Dover's Powder - - - 15 grains.
Aspirin - - - - 5 grains.

The powder to be taken thrice daily until fever subsides.

(2) *Cough.*

Ammonium Carbonate 4 drachms.
Tincture of Cinchona - 1½ ounces.
Aromatic Spirits of Ammonia - - - 4 drachms.
Chloroform Water to 12 ounces.

One tablespoonful every 4 hours.

(3) *Gastric Pain and Vomiting.*

Sodium Bicarbonate -
Magnesia (Calcined) -
Bismuth Salicylate - } of each 5 grains.

The powder to be taken twice or thrice daily.

(4) *Headache, Pains, Sleeplessness.*

Chloral Hydrate - - 15 grains.
Tincture of Orange - ½ drachm.
Water - - - to ½ ounce.

One tablespoonful twice or thrice daily.

GLOSSARY

OF MEDICAL AND SCIENTIFIC TERMS

THIS glossary has been compiled to facilitate reference to the meaning and pronunciation of all the medical and scientific terms used in *The Golden Health Library.* In the case of the better-known diseases and other terms of which an extended definition is given in the text, it has been thought advisable to refer the reader directly to the appropriate page, either in the glossary itself or in black type under the proper heading in the General Index. Derived words such as adjectives and adverbs, whose meaning is immediately apparent from the definition of the root word, are listed without explanation.

SCHEME OF PRONUNCIATION

All words in the glossary, except derived words whose pronunciation is readily obtained from that of the main entry, are completely re-spelt in a simple phonetic form. With the exception of *g* the consonants employed retain their name sounds, and the vowels, unless marked, retain their short sounds. The diagraph *aw* represents the sound of *a* heard in " fall " ; *ou* the sound of *ow* heard in " now " ; *oo* unmarked, the sound heard in " book " ; *ȯȯ* the sound heard in " moon." The following is the key to the long and peculiar vowel sounds :—

fāte, fȧr, ạdo; mē, hẹr; mīne; nōte; tūne; mȯȯn.

ACCRETION (ạ-krē′shun) *n.* the process of growing continuously.

ACETONE (as′e-tōn) *n.* a substance excreted in the urine in acidosis, a condition caused by diabetes, starvation or extreme vomiting.

ACHONDROPLASIA (ak-on-drō-plā′zi-ạ) *n.* a form of dwarfism.

ACIDOSIS (as-i-dō′sis) *n.* a toxic condition believed to be due to diminished alkalinity of the blood, sometimes occurring in diabetes.

ACROMEGALY (ak-rō-meg′ạ-li) *n.* p. 556.

ACNE (ak′nē) *n.* inflammation of the glands of the skin giving rise to blackheads.

ACTINIC (ak-tin′ik) *a.* a term applied to the ultra-violet rays of sunlight.

ACTINOTHERAPY (ak-tin-ō-thẹr′ạ-pi) *n.* treatment by actinic or ultra-violet rays.

ADENITIS (ad-e-nī′tis) *n.* inflammation of a gland.

ADENOMA (ad-e-nō′mạ) *n.*; *pl.* **-ata:**—p. 836.

ADIPOSE (ad′i-pōs) *a.* fatty.—**adiposity** *n.*

ADRENAL GLAND (ad-rē′nạl gland) *n.* the ductless gland on the top of the kidney.

ADRENALIN (ad-ren′ạ-lin) *n.* the internal secretion of the adrenal gland.

AEROBIC (ā-e-rob-ik) *a.* p. 1011.

AFFERENT (af′e-rent) *a.* leading to.

AGGLUTININ (a-glȯȯ′ti-nin) *n.* a substance in the blood which sticks together bacteria and so inhibits their harmful activities.

ALBINO (al-bē′nō) *n.* a person or animal without pigment.—**albinism** (al′bi-nizm) *n.*

ALBUMEN (al-bū′men) *n.* a protein substance like white of egg which coagulates on heating.

ALBUMINURIA (al-bū-mi-nū′ri-ạ) *n.* the presence of albumen in the urine, usually evidence of kidney inflammation.

ALDEHYDE (al′de-hīd) *n.* a volatile fluid with a suffocating smell, obtained by the oxidation of alcohol.

ALIMENTARY (al-i-men′tạ-ri) *a.* pertaining to the absorption of nourishment.—**alimentary canal** *n.* the whole digestive tube.

ALKALI (al′kạ-lī) *n.* a substance which combines with an acid to form a salt, and with a fat to form a soap.— **alkaline** (al′kạ-līn) *a.*

ALKALOID (al′kạ-loid) *n.* an organic substance obtained from plants and possessed of powerful action on the human body.

ALLANTOIS (ạ-lan′tō-is) *n.* a temporary structure formed during the development of the embryo.

ALOPECIA (al-ō-pē′si-ạ) *n.* baldness.

ALVEOLUS (al-vē′ō-lus) *n.*; *pl.* **alveoli,** a term applied to the sockets of the teeth.

AMAUROTIC (am-aw-rot′ik) *a.* pertaining to **amaurosis,** a form of blindness.

AMBLYOPIA (am-bli-ō′pi-ạ) *n.* blindness.

AMENORRHŒA (ạ-men-ō-rē′ạ) *n.* absence of the menstrual flow.

AMENT (am′ent) *n.* a mentally defective person.—**amentia** (ạ-men′shi-ạ) *n.*

AMIDE (am′id) *n.* a compound ammonia.
AMINO-ACID (am′i-nō-as′id) *n.* an end-product of protein digestion.
AMNESIA (am-nē′si-a) *n.* loss of memory.
AMNIOTIC FLUID (am-ni-ot′ik flōō′id) *n.* the watery fluid in which the foetus floats.
ANABOLISM (an-ab′o-lizm) *n.* p. 319.
ANÆMIA (a-nē′mi-a) *n.* bloodlessness.
ANÆROBIC (an-ā-e-rob′ik) *a.* p. 1011.
ANÆSTHESIA (an-es-thē′zi-a) *n.* absence of power to feel.
ANÆSTHETIC (an-es-thet′ik) *n.* an agent such as chloroform which has the power to produce insensibility.
ANAPHYLAXIS (an-a-fī-lak′sis) *n.* sensitiveness to proteins, which therefore act as poisons.
ANATOMY (a-nat′ō-mi) *n.* the science of the structure of the body.
ANEURISM (an′ū-rizm) *n.* a localised dilatation of a blood-vessel.
ANGINA PECTORIS (an-jī′na pek′to-ris) *n.* p. 399.
ANGIOMA (an-ji-ō′ma) *n.* a simple tumour formed of blood vessels.
ANOPHELES (a-nof′i-lēs) *n.* the genus of mosquitoes which convey malarial fevers.
ANTE-NATAL (an-tē-nā′tal) *a.* before birth.
ANTHRACOSIS (an-thra-kō′sis) *n.* p. 1596.
ANTHRAX (an′thraks) *n.* wool-sorters' disease, p. 1610.
ANTHROPOMETRIC (an-thrō-po-met′rik) *a.* pertaining to **anthropometry** or scientific measurement of the human body.
ANTI-BODY (an-ti-bod′i) *n.* a substance in the blood-serum which neutralises the products of bacterial growth.
ANTI-NEURITIC (an-ti-nū-rit′ik) *n.* a substance which prevents neuritis or nerve inflammation, usually applied to vitamin B.—*a.*
ANTI-RACHITIC (an-ti-ra-kit′ik) *n.* a substance or agency which prevents rickets, often applied to vitamin D.—*a.*
ANTI-SCORBUTIC (an-ti-skor-bū′tik) *n.* a substance containing vitamin C, such as orange juice, which prevents scurvy.—*a.*
ANTISEPTIC (an-ti-sep′tik) *n.* a substance or agent used to prevent bacterial growth.—*a.*
ANTITOXIN (an-ti-tok′sin) *n.* an antidote formed by the blood to counteract germs.
ANTI-XEROPHTHALMIC (an-ti-zē-rof-thal′mik) *n.* a substance which prevents xerophthalmia, an eye disease (*e.g.*,vitamin A.).—*a.*
ANTRUM (an′trum) *n.* a cave ; applied to the air cells in the upper jawbones and the mastoid bones in the skull.
ANUS (ā′nus) *n.* the external opening of the lower end of the digestive canal.—**anal** *a.*
AORTA (ā-or′ta) *n.* the large artery arising from the left side of the heart, from which arise the vessels that supply the whole body with arterial blood.—**aortic** *a.*—**aortitis** (ā-or-tī′tis) *n.* p. 424.
APERIENT (ā-pē′ri-ent) *n.* a medicine (chemical substance) with a mildly purgative action.
ARACHNOID (a-rak′noid) *n.* the transparent membrane covering the brain.
AREOLA (a-rē′ō-la) *n.* the pigmented skin around the nipple of the breast.
ARTERIAL (ár-tē′ri-al) *a.* referring to the **arteries,** the elastic tubes which convey blood away from the heart.
ARTERIOLE (ár-tē′ri-ōl) *n.* a small artery.
ARTERIO-SCLEROSIS (ár-tē′ri-ō-skle-rō′sis) *n.* hardening of the arteries.
ARTHRITIS (ár-thrī′tis) *n.* inflammation of a joint.
ASEPTIC (a-sep′tik) *a.* free from germs.
ASPERGILLOSIS (as-per-jil-ō′sis) *n.* a respiratory disease due to the inhalation of a fungus in certain industries.
ASPHYXIA (as-fik′si-a) *n.* originally meant pulselessness ; now means deprivation of air and consequent suffocation.
ASSIMILATION (a-sim-i-lā′shun) *n.* absorption of nourishment by living tissues.
ASTIGMATISM (a-stig′ma-tizm) *n.* inequalities of the curvatures of the corneæ or lenses of the eyes causing blurring of vision.
ASTRAGALUS (as-trag′al-us) *n.* ankle-bone.
ASTRINGENT (as-trin′jent) *n.* a substance which causes coagulation of protein.—*a.*
ATAXIA (a-tak′si-a) *n.* irregular or disordered movement.
ATHEROMA (ath-e-rō′ma) *n.* p. 424.
ATOMISATION (at-om-ī-zā′shun) *n.* reduction to very minute particles.
ATROPHY (at′rō-fi) *n.* wasting, due either to disease or disuse.
AURA (aw′ra) *n.* a warning previous to an epileptic seizure.
AURICLE (aw′ri-kl) *n.* the ear ; one of the two heart chambers in which blood is received before being sent to the ventricles.
AUTISTIC (aw-tis′tik) *a.* a psychological term applied to undirected thinking.
AUTOCLAVED (aw′tō-klāvd) *a.* pertaining to **autoclave,** an apparatus for sterilising by steam.
AUTO-EROTIC (aw-tō-e-rot′ik) *a.* self-loving a psychological term.
AUTOGAMY (aw-tog′a-mi) *n.* self-fertilisation.
AUTO-INTOXICATION (aw-tō-in-tok-si-kā′shun) *n.* self-poisoning.
AUTOMATISM (aw-tom′a-tizm) *n.* a mental state in which acts are performed independently of the will, sometimes seen after an epileptic seizure.
AUTONOMIC (aw-tō-nom′ik) *a.* working independently of the mind.
AXILLA (ak-sil′a) *n.* ; *pl.* **axillæ,** armpit.—**axillary** *a.*

fāte, fár, ado ; mē, her mīne ; nōte ; tūne ; mōōn.

AXON (ak′son) *n.* the chief profess of a nerve cell by means of which the cell impulse is transmitted.

B

BACILLIFEROUS (bạ-sil-if′e-rus) *a.* carrying germs or **bacilli.**

BACTERICIDAL (bak-te-ri-sī′dạl) *a.* capable of killing **bacteria** or germs.

BALNEOLOGY (bal-nē-ol′ō-ji) *n.* the study of baths and waters.

BASOPHILIA (bā-sō-fil′i-ạ) *n.* a condition of the red blood-cells in which small bluish dots appear—a result of lead-poisoning.

BERI-BERI (ber′i-ber-i) *n.* an acute neuritis common in some parts of the tropics, associated with anæmia and dropsy, due to deficiency of vitamin B.

BICEPS (bī′seps) *n.* the two-headed muscle in front of the humerus or upper arm-bone.

BILE (bīl) *n.* the greenish fluid produced by the liver and stored in the gall-bladder.—**biliary** (bil′yạ-ri) *a.*

BIOMETRICIAN (bī-ō-me-trish′ạn) *n.* one who calculates the probable duration of life.

BLOOD-PRESSURE (blud-presh′ur) *n.* the force required to maintain the circulation of the blood in the blood-vessels.

BOLUS (bō′lus) *n.* a chewed mass of food.

BORACISED (bō′rạ-sīzd) *a.* rendered antiseptic with boric acid.

BOTULISM (bot′ū-lizm) *n.* a form of meat-poisoning due to a specific germ.

BOUGIE (bōō′zhi) *n.* a slender instrument for dilating contracted passages.

BRACHIAL (brak′i-ạl) *a.* pertaining to the arm.

BRONCHI (brong′kī) *n.pl.* the two tubes into which the wind-pipe divides.—**bronchitis** *n.*

BRONCHIECTASIS (brong-ki-ek-tā′sis) *n.* a dilated condition of the bronchial tubes.

BRONCHIOLE (brong′ki-ōl) *n.* a minute bronchial tube.

BUBONIC PLAGUE (bū-bon′ik plāg) *n.* a disease caused by the bacillus pestis in which the glands become enlarged and suppurating.

C

CACHEXIA (kạ-kek′si-ạ) *n.* emaciation and exhaustion from some wasting disease.

CÆCUM (sē′kum) *n.* a cul-de-sac at the commencement of the large intestine.—**cæcal** *a.*

CAFFEINE (kaf′ēn) *n.* the stimulating product (alkaloid) present in coffee.

CALCANEOUS (kal-kā′ni-us) *n.* heel-bone.

CALCAREOUS (kal-kā′ri-us) *a.* containing lime.

CALCIUM (kal′si-ŭm) *n.* a mineral element essential for the body-cells.

CALCULUS (kal′kū-lus) *n.* stone.

CALLUS (kal′us) *n.* the new bone formed when a fractured bone unites.

CALORIE (kal′ō-ri) *n.* a scientific term for a standard unit of heat. The value of foodstuffs is estimated by the number of calories of heat they produce in a **calorimeter.**

CANCEROGENOUS (kan-sẹr-oj′i-nus) *a.* cancer-producing.

CANINE TEETH (kạ-nīn′ tēth′) *n.pl.* the four eye-teeth.

CANNULA (kan′ū-lạ) *n.* see TROCAR.

CAPILLARY (kạ-pil′ạ-ri) *n.* a minute blood-vessel connecting a vein and artery.—*a.*

CARBOHYDRATE (kȧr-bō-hī′drāt) *n.* a substance composed of carbon, oxygen, hydrogen, *e.g.* sugar, starch.

CARCINOMA (kȧr-si-nō′mạ) *n.*; *pl.* **carcinomata,** cancer.

CARDIAC (kȧr′di-ak) *a.* referring to the heart.

CAROTID (kạ-rot′id) *a.* referring to the large arteries which are placed deep in the neck and supply the head and brain with blood.

CARPUS (kȧr′pus) *n.* the wrist.

CARTILAGE (kȧr′ti-lāj) *n.* gristle; elastic substance found in relation to the bony structure of the body.

CATARRH (kạ-tȧr′) *n.* inflammation of a mucous membrane with discharge of mucus.

CAUSTIC (kaws′tik) *n.* a substance which burns living tissue.—*a.*

CAUTERISATION (kaw-tẹr-ī-zā′shun) *n.* the burning of a tissue by means of a corrosive acid or by an electrical device.

CELLULITIS (sel-ū-lī′tis) *n.* inflammation of the skin.

CELLULOSE (sel′ū-lōs) *n.* the hard, woody fibre present in fruits and vegetables.

CEREBELLUM (se-re-bel′um) *n.* the hind brain, concerned with the maintenance of balance and posture.—**cerebellar** *a.*

CEREBRO-SPINAL (se-rē′brō-spī′nạl) *a.* pertaining to the brain and the spinal cord.

CEREBRUM (se′re-brum) *n.* larger part of the brain occupying the cranium.—**cerebral** *a.*

CERVICAL (sẹr′vi-kạl) *a.* pertaining to the neck.

CERVIX (sẹr′viks) *n.* neck, *e.g.*, of the womb.

CHALYBEATE (kạ-lib′ē-āt) *a.* containing lime.

CHLORATE (klo′rāt) *n.* compound of hydrochloric acid and a base.

CHLOROPHYLL (klō′ro-fil) *n.* the green colouring matter in plants.

CHLOROSIS (klo-rō′sis) *n.* simple form of bloodlessness formerly common in girls.

CHOLERA (kol′e-rạ) *n.* an epidemic disease.

CHOLESTEROL (ko-les′te-rol) *n.* a fatty crystal found in the brain, blood, and bile.

CHOREA (kō-rē′ạ) *n.* St. Vitus' Dance, a rheumatic disease in which involuntary twitching of the muscles occurs.

CHOROID (kor′oid) *n.* p. 673.

CHORION EPITHELIOMA (kō'ri-on ep-i-thē-li-ō'ma) *n.* p. 886.

CHROMATIN (krō'ma-tin) *n* a particle in the nucleus of a cell which absorbs coloured dyes.

CHROMOSOME (krō'mo-sōm) *n.* the bearer of hereditary characteristics in the germ-cell.

CHRONDROMA (kron-drō'ma) *n.*; *pl.* **chrondromata,** p. 836.

CIRCUMCISION (ser-kum-sizh'on) *n.* the operation of removing the foreskin.

CIRCUMVALLATE (ser-kum-val'āt) *a.* walled in; the term applied to certain elevations at the base of the tongue concerned with taste.

CIRRHOSIS (si-rō'sis) *n.* p. 524.

CLAVICLE (klav'i-kl) *n.* the collar-bone.

CLIMACTERIC (klī-mak'te-rik) *n.* the change of life in women, between about 40 and 50.

CLITORIS (klit'or-is) *n.* a small erectile organ situated above the aperture of the vagina.

COAGULATE (kō-ag'ū-lāt) *v.t* and *i.* to clot or render semi-solid.

COCCYX (kok'siks) *n.* the tail-like termination of the spine, comprising the last four vertebræ.

COLIC (kol'ik) *n.* pain spasm of a muscular hollow organ, *e.g.*, gall-bladder or bowel.

COLITIS (kō-lī'tis) *n.* inflammation of the **colon** or large bowel.

COMEDO (kom'e-dō) *n.*; *pl.* **comedones** (kom-e-dō'nēz) blackhead.

COMMINUTED (kom'i-nū-ted) *a.* broken into a number of fragments.

CONDYLE (kon'dil) *n.* a round projection at the ends of some bones.

CONVOLUTED (kon-vō-lū'ted) *a.* rolled together, or one part on another.

CORONARY (ko-rō'na-ri) *a.* placed like a crown, *e.g.*, **coronary arteries.**

CORPUSCLE (kor'pus-l) *n.* the term usually applied to a blood-cell,

CORROSIVE (ko-rō'siv) *n.* a substance which corrodes or eats away.—*a.*

CORTEX (kor'teks) *n.* the outer cell-layer of an organ, *e.g.*, **brain cortex,** grey matter.

CORYZA (ko-rī'za) *n.* cold in the head.

CRANIUM (krā'ni-um) *n.* skull.—**cranial** *a.*

CRETINISM (krē'ti-nizm) *n.* a disease caused by deficiency of thyroid secretion.—**cretin** *n.*

CRICOID CARTILAGE (krī'koid kär'ti-lāj) *n.* a ring-shaped cartilage below the thyroid.

CUBOID (kū'boid) *n.* a small bone in the foot.

CULEX (kū'leks) *n.* the typical genus of gnats or mosquitoes.

CUNEIFORM (kū-nē'i-form) *n.* and *a.* the term applied to the small bones of the foot.

CURETTING (kū-ret'ing) *n.* the operation of removing the mucous membrane of the womb.

CUTANEOUS (kū-tā'nē-us) *a.* pertaining to the skin.

CYANOSIS (sī-a-nō'sis) *n.* a blue appearance, usually due to a congestion of the veins.

CYSTINE (sis'tin) *n.* containing sulphur.

CYSTITIS (sis-tī'tis) *n.* inflammation of the urinary bladder.

CYSTOCELE (sis'tō-sēl) *n.* p. 900.

CYSTOSCOPE (sis'tō-skōp) *n.* an instrument for examining the interior of the bladder.

D

DECORTICATE (dē-kor'ti-kāt) *v.t.* to remove the outer layer of an organ.

DEFECATE (def'e-kāt) *v.i.* to evacuate the bowels.

DEGENERATION (de-jen-er-ā'shun) *n.* gradual disintegration and replacement by a lower type of tissue—*e.g.*, **fatty degeneration.**

DEMENT (de-ment') *n.* a mentally enfeebled person.—**dementia** (de-men'shi-a) *n.*

DEMULCENT (dē-mul'sent) *n.* a soothing agent; an agent which protects sensitive surfaces from irritation.—*a.*

DENDRITE (den'drīt) *n.* the branching process of a nerve-cell linking it to other cells.

DENGUE (deng'gā) *n.* a continued infectious fever common in hot climates.

DENTINE (den'tēn) *n.* the substance which forms the body of a tooth.

DEPILATION (dep-i-lā'shun) *n.* the removal of hair.

DEPURATED (dep'ū-rā-ted) *a.* purified.

DERMATITIS (der-ma-tī'tis) *n.* inflammation of the skin.

DERMATOLOGY (der-ma-tol'ō-ji) *n.* the science of the skin and its diseases.

DERMATOSIS (der-ma-tō'sis) *n.*; *pl.* **dermatoses,** a skin disease of nervous origin.

DERMIS (der'mis) *n.* the skin.

DERMOID CYST (der'moid sist') *n.* a cyst containing epithelial substances, especially hair, teeth, and sebaceous material.

DETERGENT (de-ter'jent) *n.* a cleansing agent.

DEXTRINISE (deks'tri-nīz) *v.t.* to convert into **dextrose** or grape sugar.

DIABETES (di-a-bē'tēz) *n.* a disease characterised by the presence of sugar in the urine.

DIAGNOSIS (dī-ag-nō'sis) *n.* the recognition of a disease by its symptoms.—**diagnostician** *n.*

DIAPHORETIC (dī-a-fo-ret'ik) *n.* a substance which promotes perspiration.

DIAPHRAGM (dī'a-fram) *n.* the dome-shaped muscle separating the thoracic or chest cavity from the abdominal cavity or belly.

DIASTOLE (dī-as'to-lē) *n.* the normal dilatation of the heart following its contraction or "systole."

DIATHERMY (dī-a-ther'mi) *n.* a process by which electric currents are passed into the deeper parts of the body to produce internal warmth and relieve pain.

DIATHESIS (dī-ath'e-sis) *n.* inherited disposition to disease, *e.g.*, **gouty diathesis.**—**diathetic** (dī-a-thet'ik) *a.*
DIETETICS (dī-e-tet'iks) *n.* the science of food and nutrition.
DIGITAL (dij'i-tal) *a.* referring to the fingers.
DIGITONIN (dij-i-tō'nin) *n.* a drug derived from **digitalis** (foxglove) with a powerful action on the heart.
DIPLOCOCCUS (dip-lō-kok'us) *n.* p. 1010.
DIPSOMANIA (dip-sō-mā'ni-a) *n.* p. 947.
DORSUM (dor'sum) *n.* the back of a part, *e.g.*, hand or foot.—**dorsal** *a.*
DROPSICAL ((drop'si-kal) *a.* unnatural distension of tissues with watery fluid.
DUCTLESS GLAND (dukt'les gland') *n.* a gland which pours its secretion directly into the blood stream.
DUODENUM (dū-ō-dē'num) *n.* the horseshoe-shaped portion of the small intestine, commencing at the stomach and continuing into the jejunum.—**duodenal** *a.*
DURA MATER (dū'ra mā'ter) *n.* the thick, tough membrane protecting the brain.
DYSENTERY (dis'en-ter-i) *n.* an inflammatory disease of the large bowel due to parasites or bacterial infection.
DYSGENIC (dis-jen'ik) *a.* having a deteriorating influence on the race.
DYSPNŒA (dis-pnē'a) *n.* breathlessness.

E

ECCHYMOSIS (ek-i-mō'sis) *n.* a bruise; an effusion of blood under the skin.
ECLAMPSIA (ek-lamp'si-a) *n.* a general term for convulsive seizures of sudden onset.
ECTODERM (ek'to-derm) *n.* the outer layer of cells in the embryo.
ECTOPIC PREGNANCY (ek-top'ik preg'nan-si) *n.* p. 887.
ECZEMATOUS (ek-zem'a-tus) *a.* relating to eczema, an irritating eruption of the skin.
EFFERENT (ef'e-rent) *a.* going from.
EFFLUENT (ef'loo-ent) *n.* that which flows out.
EFFUSION (e-fū'zhun) *n.* a gathering of fluid.
EGOCENTRIC (eg-o-sen'trik) *a.* self-centred; excessively selfish.
ELECTROLYSIS (e-lek-trol'i-sis) *n.* application of electric current with fine needles for destruction of moles or superfluous hairs.—**electrolytic** (e-lek-tro-lit'ik) *a.*
ELECTRON (e-lek'tron) *n.* the ultimate unit of matter.
ELEPHANTIASIS (el-e-fan-tī'a-sis) *n.* great enlargement of some part of the body, usually a limb, due to blocking of the lymphatic vessels by inflammation or by parasites.
EMBOLISM (em'bo-lizm) *n.* p. 1169.
EMBOLUS (em'bo-lus) *n.* p. 388.
EMBRYO *(em'bri-ō) n. the foetus (unborn* child) before it has quickened.
EMETIC (e-met'ik) *n.* an agent for producing vomiting, *e.g.*, soapy water.—*a.*
EMMETROPIC (em-e-trop'ik) *a.* pertaining to **emmetropia**, a term applied to normal sight.
EMOLLIENT (e-mol'i-ent) *a.* soothing.
EMPHYSEMA (em-fi-zē'ma) *n.* a condition of distention with breaking down of the air-cells in the lungs, associated with bronchitis.
ENDOCARDITIS (en-dō-kār-dī'tis) *n.* inflammation of the valves of the heart.
ENDOCARDIUM (en-dō-kār'di-um) *n.* p. 387.
ENDOCRINE (en'dō-krēn) *a.* the term used to denote the tissues and organs which give rise to an internal secretion.
ENDOSPERM (en'do-sperm) *n.* p. 1365.
ENDOTHELIUM (en-do-thē'li-um) *n.* the fine cells lining the heart cavities and the blood vessels.—**endothelial** *a.*
ENDOTOXIN (en-do-tok'sin) *n.* p. 1016.
ENURESIS (en-ū-rē'sis) *n.* incontinence, inability to hold the urine.
ENZYME (en'zīm) *n.* any ferment produced by the living cells of the body.
EPIDERMIS (ep-i-der'mis) *n.* the surface layer of the skin.—**epidermiology** *n.*
EPIDIDYMIS (ep-i-did-i-mis) *n.* p. 655.
EPIGASTRIC (ep-i-gas'trik) *a.* pertaining to the region in front of the stomach.
EPIGLOTTIS (ep-i-glot'is) *n.* the flap of cartilage which guards the aperture of the larynx and prevents food from passing into the windpipe.
EPIPHORA (e-pif'o-ra) *n.* an excessive flow of tears.
EPIPHYSIS (e-pif'i-sis) *n.* the growing end of a bone.
EPISTAXIS (ep-i-stak'sis) *n.* nose-bleeding.
EPITHELIOMA (ep-i-thē-li-ō'ma) *n.* p. 629.
EPITHELIUM (ep-i-thē'li-um) *n.* the cells on the surface of the skin, mucous membranes, and some glands.—**epithelial** *a.*
EPULIS (ep'ū-lis) *n.* p. 838.
ERGOGRAPH (er'gō-grāf) *n.* an instrument for measuring output of work and fatigue.
ERGOSTEROL (er-gō-ster'ol) *n.* p. 1327.
ERGOT (er'got) *n.* a drug obtained from a fungus which grows on rye, used after labour to contract the womb and so arrest bleeding.—**ergotism** (er'go-tizm) *n.* p. 1336.
EROTIC (e-rot'ik) *a.* pertaining to love.
EROTICISE (e-rot'i-siz) *v.t.* to make erotic.
ERYSIPELAS (e-ri-sip'e-las) *n.* an acute inflammation of the skin.
ERYTHEMA (e-ri-thē'ma) *n.* a red eruption.
ETIOLOGY (ē-ti-ol'ō-ji *n.* the science of the causation of disease.
EUGENICS (ū-jen'iks) *n.* the study of means to improve the racial stock.
EXACERBATE (eg-zas'er-bāt) *v.t.* to increase

in severity (of symptoms).—**exacerbation** *n.*

EXANTHEMATIC (eg-zan-the-mat´ik) *a.* pertaining to **exanthemata,** diseases accompanied by specific rashes.

EXCORIATED (eks-kō´ri-ā-ted) *a.* cracked.

EXOSTOSIS (eks-os-tō´sis) *n.* p. 836.

EXTRACAPSULAR (eks-trạ-kap´sū-lạr) *a.* outside the capsule of a joint.

EXTRACELLULAR (eks-trạ-sel´ū-lạr) *a.* outside a cell.

EXTRAVERT (eks´trạ-vẹrt) *n.* p. 958.—**extraversion** (eks-trạ-vẹr´shun) *n.*

EXTROVERSION (eks-trō-vẹr´shun) *n.* (of the bladder) a congenital deformity in which the bladder is exposed through the abdominal wall.

F

FÆCES (fē´sēz) *n.pl.* the refuse material expelled from the bowels.—**fæcal** (fē´kạl) *a.*

FALLOPIAN TUBES (fạ-lō´pi-ạn tūbs) *n.pl.* two trumpet-like canals, about 3 inches long, passing from the ovaries to the womb.

FARINACEOUS (fạ-ri-nā´shi-us) *a.* containing flour or grain.

FASCIA (fas´si-ạ) *n.*; *pl.* **fasciæ,** a fibrous structure separating one compartment of the body or one muscle from another.

FAUCES (faw´sēz) *n.pl.* the short passage between the back of the mouth and the pharynx.

FEBRILE (fē´bril) *a.* relating to fever.

FEMORAL (fem´o-rạl) *a.* relating to the **femur** or thigh-bone.

FIBRIL (fī´bril) *n.* a small fibre.—**fibrillary** *a.*

FIBROMA (fī-brō´mạ) *n.*; *pl.* **-ata,** p. 835.

FIBRO-SEROUS (fī-br-ōsē´rus) *a.* composed of fibrous and serous tissue, *e.g.*, the peritoneum lining of the abdominal cavity.

FIBROSIS (fī-brō´sis) *n.* conversion into fibrous tissue—**fibrotic** *a.*

FIBROSITIS (fī-brō-sī´tis) *n.* inflammation of fibrous tissue.

FIBULA (fib´ū-lạ) *n.* the slender bone on the outer side of the leg.

FILARIASIS (fil-ạ-rī´ạ-sis) *n.* a disease caused by a parasitic worm under the skin.

FILIFORM (fil´i-form) *a.* thread-like.

FILTERABLE (fil´tẹr-ạ-bl) *a.* able to pass through a filter, a term applied to certain ultra-microscopic germs or viruses.

FISSION (fish´un) *n.* p. 1011.

FISTULA (fis´tū-lạ) *n.* any unnatural passage by which an internal organ communicates with another or with the outside of the body.

FLAGELLUM (flạ-jel´um) *n.* a whip-like appendage.

FLATUS (flā´tus) *n.* gas or air in the stomach or intestines.

FLOCCULENT (flok´ū-lent) *a.* flaky.

FOETUS (fē´tus) *n.* the unborn child from the fourth month.—**foetal** *a.*

FONTANELLE (fon´tạ-nel) *n.* a space in the skull of an infant before the skull has completely ossified.

FORAMEN (fo-rā´men) *n.* an aperture.

FORENSIC MEDICINE (fo-ren´sik med´sin) *n.* medicine in so far as it has to deal with law.

FOSSA (fos´ạ) *n.*; *pl.* **fossæ,** a depression.

FRENUM (frē´num) *n* a small membranous fold attached to certain organs, *e.g.*, the tongue, and acting as a check.

FRUCTOSE (fruk´tōs) *n.* fruit sugar.

FUGUE (fūg) *n.* absent-minded wandering.

FUNDUS (fun´dus) *n.* the body of an organ.

FUNGATING (fung-gā´ting) *a.* growing luxuriantly like a fungus.

FUNGIFORM (fung´gi-form) *a.* like a fungus.

FURFUROL (fur´fur-ol) *n.* a volatile oil obtained when wheat-bran, sugar, or starch is acted on by dilute sulphuric acid.

FUSIFORM (fū´zi-form) *a.* spindle-shaped.

G

GANGLION (gang´gli-on) *n.* anatomically: a swelling upon the course of a nerve containing nerve-cells; surgically: an enlargement of the sheath of a tendon containing fluid.

GANGRENE (gang´grēn) *n.* tissue death.

GASTRIC (gas´trik) *a.* pertaining to the stomach.

GASTRO-ENTERITIS (gas´trō-en-te-rī´tis) *n.* inflammation of the stomach and intestines.

GASTRONOMIC (gas-trō-nom´ik) *a.* pertaining to **gastronomy**—the art of good eating.

GENEALOGY (jen-i-ạl´ō-ji) *n.* history of the descent of families.—**genealogical** *a.*

GENETOUS IDIOCY (jen´e-tus id´i-ō-si) *n.* simple idiocy due to lack of development of brain cells.

GENITALIA (jen-i-tā´li-ạ) *n.pl.* sexual organs.

GENITO-URINARY TRACT (jen´i-tō-ū´ri-nạ-ri) *n.* the passages concerned with the sexual and excretory functions.

GERMICIDE (jẹr´mi-sīd) *n.* an agent for killing germs or bacteria.

GERM-PLASM (jẹrm´plazm) *n.* the living material which transmits the current of life.

GESTATION (jes-tā´shun) *n.* the condition of carrying young in the womb.

GLANDERS (glân´dẹrz) *n.* p. 1579.

GLAUCOMA (glaw-kō´mạ) *n.* an eye disease causing blindness.

GLENOID CAVITY (glē´noid kav´i-ti) *n.* the socket of the shoulder joint.

GLIOMA (glī-ō´mạ) *n.*; *pl.* **gliomata,** p. 838.

GLOBULIN (glob´ū-lin) *n.* p. 1366.

GLOTTIS (glot´is) *n.* the narrow opening into the wind-pipe.

GLUTAMIC ACID (glōō-tam´ik as´id) *n.* a

product of the splitting up of vegetable protein.

GLUTATHIONE (gloo-tạ-thī'ōn) *n.* p. 1298.

GLUTEAL (gloo-ti-ạl) *a.* pertaining to the buttock.

GLUTEN (gloo'ten) *n.* the nitrogenous part of the flour of wheat and other grains.

GLUTENIN (gloo'ten-in) *n.* p. 1366.

GLYCOGEN (glī-kō-jen) *n.* liver sugar.

GLYCOSURIA (glī-kō-sū'ri-ạ) *n.* the occurrence of sugar in the urine.

GONOCOCCUS (gon-o-kok'us) *n.*; *pl.* **gonococci**, p. 1016.

GREENSTICK (grēn'stik) *n.* p. 1133.

GUMMA (gum'ạ) *n.*; *pl.* **gummata**, a soft, tumour-like mass occurring in tissues and organs as a result of syphilis.

H

HÆMANGIOMA (hem-an-ji-ō'mạ) *n.*, *pl.* **hæmangiomata**, p. 838.

HÆMATOMA (hem-ạ-tō'mạ) *n.* a blood-clot forming a tumour-like mass.

HÆMATURIA (hem-ạ-tū'ri-ạ) *n.* p. 1114.

HÆMOGLOBIN (hem-ō-glō'bin) *n.* the iron compound of the red blood-corpuscles which enables them to carry oxygen.

HÆMOPHILIA (hem-ō-fil'i-ạ) *n.* a disease in which the blood does not clot when shed.

HÆMOPTYSIS (he-mop'ti-sis) *n.* p. 1114.

HÆMORRHAGE (hem'o-rij) *n.* bleeding.

HÆMORRHOIDS (hem'-o-roidz) *n.pl.* piles, a dilated and twisted mass of veins at the lower end of the rectum.

HALLUS VALGUS (hal'us val'gus) *n.* p. 565.

HALLUCINOSIS (hạ-loo-si-nō'sis) *n.* a state of receiving imaginary impressions.

HEBEPHRENIA (heb-e-fren'ia) *a.* a state of dulling and blunting of the mind, a variety of the mental disease known as dementia præcox.

HELIOTHERAPY (hē-li-o-ther'ạ-pi) *n.* treatment by sunlight, real or artificial.

HEPATIC (he-pat'ik) *a.* relating to the liver.

HERMAPHRODITE (her-maf'ro-dīt) *n.* an animal in possession of the sexual organs of both sexes.

HERNIA (her'ni-ạ) *n.* rupture.

HERPES (her'pēz) *n.* shingles, an eruption consisting of very small vesicles or blisters.

HEURISTIC (hū-ris'tik) *a.* pertaining to the method of education by which the pupil is set to find out for himself.

HYBRID (hī'brid) *n.* an animal or plant produced from two different species, *e.g.*, a mule.

HYDATID CYST (hī'dạ-tid sist) *n.* p. 841.

HYDROCEPHALUS (hī-dro-sef'ạ-lus) *n.* accumulation of fluid in the cavities of the brain.

HYDROCHLORIC ACID (hī-dro-klō'rik as'id) *n.* an acid found normally in the digestive juice of the stomach.

HYDROGENATION (hi-drō-jen-ā'shun) *p.* 1292.

HYDROLISIS (hī-drol'i-sis) *n.* p. 201.

HYDROLOGY (hī-drol'ō-ji) *n.* the study of the treatment of disease by baths and water.

HYDROTHERAPY (hī-dro-ther'ạ-pi) *n.* the treatment of disease by baths.

HYMEN (hī'men) *n.* maidenhead, the fold or membrane at the entrance of the vagina.

HYOSCIAMUS (hī-ō-sī'ạ-mus) *n.* henbane; a narcotic or sedative drug commonly used in medicine, very poisonous in large doses.

HYPERACUITY (hī-per-ak-ū'i-ti) *n.* increased power of perception.

HYPERÆSTHESIA (hī-per-es-thē'zi-ạ) *n.* p. 918.

HYPERMETROPIA (hī-per-me-trō'pi-ạ) *n.* long sight.—**hypermetropic** *a.*

HYPERPLASIA (hī-per-plā'zi-ạ) *n.* a morbid multiplication of cells—pathological term.

HYPERTROPHY (hī-per'tro-fi) *n.* a multiplication of cells as a result of some stimulus.

HYPNOTIC (hip-not'ik) *a.* sleep-producing,

HYPOCHONDRIA (hip-o-kon'dri-ạ) *n.* a state of morbid concern about health, the sufferer imagining he is a victim of many diseases.

HYPOGLYCÆMIA (hī-pō-glī-sē'mi-ạ) *n.* diminished amount of sugar in the blood.

HYPOSPADIAS (hī-pō-spā'di-as) *n.* p. 864.

HYPOTHYROIDISM (hī-pō-thī'roi-dizm) *n.* deficiency of the thyroid gland secretion.

I

IDEATION (ī-dē-ā'shun) *n.* the process of thinking.

IDIOSYNCRASY (id-i-o-sin'krạ-si) *n.* p. 372.

ILEO-CÆCAL JUNCTION (il-i-ō-sē'kạl) *n.* the junction between the small intestine and the large intestine.

ILEUM (il'i-um) *n.* the lower portion of the small intestine or bowel.

ILIUM (il'i-um) *n.* the upper part of the hip-bone.—**iliac** *a.*

IMPETIGO (im-pe-tī'gō) *n.* a skin disease in which crusts form, common in poor children.

INCISOR TEETH (in-sī'sor) *n. pl.* the eight cutting teeth in front of the jaw.

INCUBATION (in-kū-bā'shun) *n.* the time between infection and the onset of disease.

INDURATION (in-dū-rā'shun) *n.* hardening.

INNERVATION (in-er-vā'shun) *n.* nerve supply.

INNOMINATE (i-nom'i-nāt) *a.* relating to the hip-bone; relating to a large artery which arises from the aorta.

INOCULATION (in-ok-ū-lā'shun) *n.* the injection of a virus with the object of preventing a specific disease.

INSULIN (in'sū-lin) *n.* the internal secretion of the pancreas, used in the treatment of diabetes.

INTEGUMENT (in-teg'ū-ment) *n.* skin, the outer covering of the body.

INTERSTITIAL (in-tẹr-stish'ạl) *a.* between the parts that compose a body.

INTRACAPSULAR (in-trạ-kap'sū-lạr) *a.* within the capsule of a joint.

INTRATHECAL (in-trạ-thē'kạl) *a.* within the spinal canal.

INTRAVENOUS (in-trạ-vē'nus) *a.* within a vein.

INTUBATION (in-tū-bā'shun) *n.* p. 729.

INUNCTION (in-ugnk'shun) *n.* the rubbing into the skin of medicines.

INVOLUTION (in-vo-lū'shun) *n.* the shrinking of an organ, *e.g.*, the womb after childbirth.

IODISED (ī'o-dīzd) *a.* impregnated with iodine.

ION (ī'on) *n.* p. 1214.

IRIS (ī'ris) *n.* the coloured muscle surrounding the pupil of the eye.

IRRADIATION (i-rā-di-ā'shun) *n.* exposure to the ultra-violet rays of the sunlight.

J

JEJUNUM (je-jōō'num) *n.* the first part of the small intestine or bowel.

JUGULAR (jug'ū-lạr) *a.* relating to the large veins in the neck which drain blood from the brain, head and neck.

K

KATABOLISM (kat-ab'o-lizm) *n.* p. 319.

KATATONIA (kat-ạ-tō'ni-ạ) *n.* a rigid state of the muscles.

KERATIN (ke'rạ-tin) *n.* hard, horny material found in nails and hair.

KERATOMALACIA (kẹr-ạ-tō-mạ-lā'si-ạ) *n.* p. 1277.

KETONE (kē'tōn) *n.* acetone, a substance produced by the imperfect oxidation of fats in the body and sometimes found in the urine in diabetes.

KLEPTOMANIA (klep-to-mā'ni-ạ) *n.* an irresistible impulse to steal.—**kleptomaniac** *n.*

KYPHOSIS (kī-fō'sis) *n.* irregular deformity of the spine ; hunch-back.

L

LACRYMAL (lak'ri-mạl) *a.* secreting or pertaining to tears.—**lacrymation** *n.*

LACTALBUMEN (lak-tal'bū-men) *n.* the albumen of milk (protein).

LACTATION (lak-tā'shun) *n.* the process or period of suckling.

LACTIC ACID (lak'tik as'id) *n.* the acid found in soured milk.

LACTOSE (lak'tōs) *n.* milk sugar.

LÆVULOSE (lev'ū-lōs) *n.* fruit sugar.

LAMINATED (lam'i-nā-ted) *a.* in layers.

LANGERHANS, ISLAND OF (lang'gẹr-hans) *n.* a group of cells in the pancreas which produce the internal secretion, called insulin.

LARYNX (lar'ingks) *n.* the throat.—**laryngeal** (lạ-rin'jē-ạl) *a.*

LATHYRISM (lath'i-rizm) *n.* p. 1336.

LEGUMIN (le-gū'min) *n.* a protein substance in the seeds of **leguminous** plants, *e.g.* the pea and the bean.

LESION (lē'zhun) *n.* any injury or morbid change.

LEUCOCYTE (lū'kō-sīt) *n.* white blood corpuscle.

LEUCOCYTOSIS (lū-kō-sī-tō'sis) *n.* a state of the blood in which there is an increased number of white blood corpuscles.

LEUKÆMIA (lū-kē'mi-ạ) *n.* a blood disease in which the white corpuscles are greatly increased in number.

LIBIDO (li-bē'dō, li-bī'dō) *n.* the energy of the sexual impulse.

LIGAMENT (lig'ạ-ment) *n.* a band of tough fibrous tissue protecting a joint.

LIGATURE (lig'ạ-tūr) *n.* thread of silk, wire, or catgut used to ligate or tie up arteries, etc.

LIPASE (lī'pāz) *n.* a fat-splitting ferment found in the digestive juice of the pancreas.

LIPOID (lip'oid) *n.* a phosphorised fat, *e.g.*, cholesterol, which enters into the composition of some body tissues, *e.g.*, brain tissue.

LIPOMA (li-pō'mạ) *n.* ; *pl.* **lipomata**, p. 835.

LITHIA (lith'i-ạ) *n.* oxide of **lithium**—an alkaline metal the salts of which are given in gout, etc., to neutralise acidity.

LIVIDITY (li-vid'i-ti) *n.* lead colour.

LOBAR (lō'bạr) *a.* affecting a lobe (of the lung), used in connection with acute pneumonia.

LOCHIA (lō'ki-ạ) *n.pl.* p. 895.

LOCOMOTOR-ATAXIA (lō-kō-mō-tor-ạ-tak'si-ạ) *n.* a syphilitic disease of the spinal cord.

LUMBAR (lum'bạr) *a.* pertaining to the back.

LUMEN (lōō'men) *n.* an aperture.

LUPUS (lōō'pus) *n.* tubercular skin disease.

LYMPH (limf) *n.* a colourless alkaline fluid found in the tissue spaces and lymphatic vessels.—**lymphatic** (lim-fat'ik) *n.* and *a.*

LYMPHANGIOMA (lim-fan-ji-ō'mạ) *n.* ; *pl.* **lymphangiomata**, p. 838.

LYMPHANGITIS (lim-fan-jī'tis) *n.* p. 442.

LYMPHOCYTE (lim'fō-sīt) *n.* a variety of white blood corpuscle.

LYSINE (lī'sēn) *n.* an amino-acid, a product of the digestion of protein.

LYSIS (lī'sis) *n.* the gradual decline of a fever.

M

MACROCEPHALY (mak-rō-sef'ạ-li) *n.* abnormally large skull cavity, usually associated with idiocy.

MALAISE (mạ-lāz') *n.* a general feeling of illness and discomfort accompanying most feverish states.

MALIC ACID (mal'ik as'id) *n.* the acid found in the apple.

fāte, fär, ạdo ; mē, hẹr ; mīne ; nōte ; trūe ; mōōn.

MALLEOLUS (mal'ē-ō-lus) *n.* the projection of the ankle-bone.
MALTOSE (mawl'tōs) *n.* malt sugar.
MANDIBLE (man'di-bl) *n.* the lower jaw-bone.
MANIC-DEPRESSIVE (man-ik-de-pres'iv) *a.* p. 934.
MANOMETER (mạ-nom'e-tẹr) *n.* an instrument for measuring blood pressure.
MASTITIS (mas-tī'tis) *n.* inflammation of the breast.
MASTOID (mas'toid) *a.* literally, breastlike. The **mastoid process** is the projecting portion of bone behind the ear.
MASTURBATION (mas-tur-bā'shun) *n.* sexual self-abuse.
MATRIX (mā'triks) *n.* the womb.
MAXILLARY (mak-sil'ạ-ri) *a.* pertaining to the **maxilla** or upper jaw-bone.
MECONIUM (me-kō'ni-um) *n.* a black material expelled from the bowels of a new born infant.
MEDULLA (me-dul'ạ) *n.* marrow (Latin).
MEDULLA OBLONGATA (me-dul'ạ ob-long-gā'tạ) *n.* the portion of the brain, containing certain vital centres, which links the brain proper to the spinal cord.
MELAENA (me-lē-nạ) *n.* p. 1114.
MEMBRANE (mem'brān) *n.* a fold of tissue. —**membranous** *a.*
MENINGEAL (me-nin'jē-ạl) *a.* pertaining to the **meninges,** the membranes surrounding the brain.
MENINGITIS (men-in-jī'tis) *n.* inflammation of the membranes surrounding the brain.
MENINGOCOCCUS (me-ning'go-kok-us) *n.* p. 1017.
MENOPAUSE (men'o-pawz) *n.* the change of life in women.
MENORRHAGIA (men-o-rā'ji-ạ) *n.* p. 875.
MENSES (men'sēz) *n.pl.* the **menstrual** or monthly flow of blood in women.
MESODERM (mes'o-dẹrm) *n.* the middle layer of cells in the embryo.
MESOTHORIUM (mes-o-tho'ri-um) *n.*
METACARPUS (met-ạ-kár'pus) *n.* the five bones of the hand joining fingers to wrist.
METATARSUS (met-ā-tár'sus) *n.* the five bones of the foot joining the ankle to the toes.
METASTATIC (met-ạ-stā'tik) *a.* changing from one place to another—a term used to describe the growth of malignant tumours.
METHANE (meth'ān) *n.* marsh gas (CH_4).
METORRHAGIA (met-o-rā'ji-ạ) *n.* p. 875.
MICROBE (mī'krōb) *n.* a germ.
MICRO-ORGANISM (mī'krō-or'gạn-izm) *n.* a low form of animal life.
MICROCEPHALY (mi-krō-sef'ạ-li) *n.* abnormally small skull cavity, usually associated with idiocy.
MICTURATE (mik'tū-rāt) *v.i.* to pass urine from the bladder.—**micturition** *n.*
MIDRIFF (mid'rif) *n.* diaphragm.
MIGRAINE (mi-grān') *n.* a form of headache accompanied by sickness and peculiar eye disturbances.
MINERAL SALTS (min'e-rạl sawlts) *n.pl.* the salts of elements such as iron, calcium, etc.
MITRAL VALVE (mī'trạl valv) *n.* the valve in the heart separating the left auricle from the left ventricle.
MOLAR TEETH (mō'lạr) *n. pl.* the twelve grinding teeth at the back of the jaw.
MORBID (mor'bid) *a.* unhealthy; diseased.
MOTILE (mō'til) *a.* actively moving.
MOTOR (mō'tor) *a.* referring to movement, *e.g.*, **motor nerves,** control the muscles.
MUCOUS MEMBRANE (mū'kus mem'brān) *n.* the lining of the respiratory, urinary and digestive tracts.
MUCUS (mū'kus) *n.* the watery secretion of the glands of the mucous membrane (*q.v.*)
MYELOCYTE (mī'e-lō-sīt) *n.* a marrow-cell, from which blood corpuscles are derived.
MYELOID (mī'e-loid) *a.* like marrow.
MYOCARDITIS (mī-ō-kár-dī'tis) *n.* inflammation of the heart muscle.
MYOCARDIUM (mī-ō-kár'di-um) *n.* p. 387.
MYOMA (mī-ō'mạ) *n.*; *pl.* **myomata,** p. 837.
MYOPIA (mī-ō'pi-ạ) *n.* short sight. **myopic** *a.*
MYOSIN (mī'ō-sin) *n.* the albuminous compound found in the contractile tissue of muscle.
MYOSITIS (mī-ō-sī'tis) *n.* inflammation of a muscle.
MYXŒDEMA (mik-se-dē'mạ) *n.* a disease due to deficiency of thyroid secretion in adults.

N

NÆVUS (nē'vus) *n.* a mole.
NARCISSISTIC (nár-sis-is'tik) *a.* self-loving (a psychological term).—**narcissism** (nár-sis'izm) *n.*
NARCOTIC (nár-kot'ik) *n.* sleep-producing.
NASO-PHARYNGEAL (nā-zō-fạ-rin'ji-ạl) *a.* referring to the space behind the nose and leading to the throat.
NAUSEA (naw'shạ) *n.* a feeling of sickness.
NAVEL (nā'vl) *n.* the umbilicus; the scar of the severed birth cord.
NECROSIS (nek-rō'sis) *n.* cell death.
NEGATIVISM (neg'ạ-tiv-izm) *n.* the mental state of doing the opposite of what one desires, occurring in a mental disease.
NEPHRITIS (nef-rī'tis) *n.* inflammation of the kidneys.
NERVINE (nẹr'vīn) *a.* referring to the nerves.
NEUROGLIA (nū-rog'li-ạ) *n.* the supporting tissue of the nervous system.
NEUROLOGY (nū-rol'ō-ji) *n.* the study of the nervous system and its diseases.
NEUROMA (nū-rō'mạ) *n.*; *pl.* **-ata,** p. 838.
NEURON (nū'ron) *n.* the nerve-cell or unit of the nervous system.

NEUROPATHIC (nū-rō-path´ik) *a.* nerve-diseased.

NEUROSIS (nū-rō´sis) *n.* a form of mental disorder in which the conduct is not materially affected.—**neurotic** (nū-ro´-tik) *a.*

NICOTINE (nik´o-tēn) *n.* the alkaloid of tobacco.

NIDUS (nī´dus) *n.* any place in the animal body in which germs lodge and multiply.

NISSL GRANULE (nisl′ gran´ūl) *n.* one of the particles of protoplasm which are found in nerve cells.

NITROGENOUS (nī-troj´e-nus) *a.* pertaining to nitrogen, a colourless gas entering largely into the composition of air.

NUCLEUS (nū´kli-us) *n.* the condensed globule of protoplasm within a cell which is vital to life. — **nucleated** *a.* containing a nucleus.

NYSTAGMUS (nis-tag´mus) *n.* lateral or rotary, spasmodic movements of the eye-balls.

O

OCCIPITAL (ok-sip´i-tạl) *a.* relating to the back of the head.

ODONTONA (ō-don-tō´nạ) *n.* p. 837.

ŒDEMA (ē-dē´mạ) *n.* dropsy; excessive fluid in the tissues.—**œdematous** *a.*

ŒSOPHAGUS (ē-sof´ạ-gus) *n.* the gullet, a tube leading from throat to stomach.

OLECRANON PROCESS (ō-lek´rạ-non) *n.* the bony point of the elbow.

OLEIN (ō´lē-in) *n.* an oily fat.

OLFACTORY (ol-fak´to-ri) *a.* referring to the sense of smell.

OPHTHALMIA NEONATORUM (of-thal´mi-ạ nē-on-ạ-to´rum) *n.* a purulent inflammation of the eyes occurring in the new-born.

ORCHITIS (or-kī´tis) *n.* inflammation of the testis.

ORTHOPÆDIC (or-tho-pē´dik) *a.* relating to the cure of deformities.

OS CALCIS (os′ kal´sis) *n.* the heel-bone.

OSSIFY (os´i-fī) *v.t.* and *i.* to turn into bone.

OSTEITIS (os-ti-ī´tis) *n.* inflammation of bone.

OSTEO-ARTHRITIS (os´ti-ō-âr-thrī´tis) *n.* a rheumatic disease of the joints.

OSTEOMA (os-ti-ō´mạ) *n.*; *pl.* **-ata,** p. 837.

OSTEOMALACIA (os-ti-ō-mal-ā´si-ạ) *n.* p. 556.

OSTEO-MYELITIS (os-ti-ō-mī-e-lī´tis) *n.* p. 556.

OTITIS (ō-tī´tis) *n.* inflammation of the ear.

OTOLOGY (ō-tol´ō-ji) *n.* the study of the ear.

OTOSCLEROSIS (ō-tō-sklc-rō´sis) *n.* p. 701.

OVARY (ō´vạ-ri) *n.* one of the pair of female organs in which the ova or eggs are formed.

OVOID (ō´void) *a.* egg-shaped.

OXIDATION (ok-si-dā´shun) *n.* the act of combination between oxygen and any other substance.

OZONE (ō´zōn) *n.* oxygen in a very active state, poisonous to low organisms and therefore antiseptic.

P

PALMAR ARCH (pal´mạr ârch′) *n.* the arterial arch in the palm of the hand from which branches arise to supply the fingers.

PALMITIN (pal´mi-tin) *n.* a fat.

PALPATE (pal-pāt′) *v.t.* to feel with the hands.

PANCREAS (pan´krē-as) *n.* a long, flat gland in the abdomen behind the stomach, supplying a digestive juice; the sweetbread.

PAPILLA (pạ-pil´lạ) *n.*; *pl.* **papillæ,** a small nipple-shaped eminence.

PAPILLARY MUSCLE (pap´i-lạ-ri mus´l) *n.* one of the small muscles that help to control the cusps of certain of the heart valves.

PAPILLOMA (pạ-pil-ō´mạ) *n.*; *pl.* **papillomata,** a wart.

PAPULE (pap´ūl) *n.* a pimple.

PARÆSTHESIA (pạ-rạ-es-thē´zi-ạ) *n.* p. 918.

PARANOIA (pạ-rạ-noi´ạ) *n.* a mental disease in which the fundamental symptom is a persecutory delusional system.—**paranoid** *a.*

PARASITE (pạ´rạ-sīt) *n.* any living thing that lives in or upon another organism, deriving nourishment from it.—**parasitology** *n.*

PARATHYROID (pạ-rạ-thī´roid) *a.* pertaining to the four small glands embedded in the posterior part of the thyroid gland.

PARATITIS (pạ-rạ-tī´tis) *n.* mumps.

PARETIC (pạ-ret´ik) *a.* referring to paralysis.

PARTHENOGENESIS (pâr-the-nō-jen´e-sis) *n.* reproduction without male intervention.

PAROTID GLAND (pa-rot´id gland) *n.* a salivary gland under the ear.

PARTURITION (pâr-tū-ri´shun) *n.* childbirth.

PASTEURISATION (pas-tẹr-ī-zā´shun) *n.* destruction of germs by heating to 158°-176°F. for half an hour.

PATELLA (pạ-tel´ạ) *n.* the knee-cap.

PATHOGENIC (path-o-jen´ik) *a.* disease-producing.

PATHOLOGY (path-ol´ō-ji) *n.* the science of diseases.—**pathologist** *n.*

PECTORAL (pek´to-rạl) *a.* referring to the region in front of the chest.

PEDUNCULATED (pe-dung´kū-lā-ted) *a.* stalked.

PELVIS (pel´vis) *n.* the bony basin composed of the hip-bones and the lower part of the spine.—**pelvic** *a.*

PENIS (pē´nis) *n.* the external sexual organ of the male.

PEPSIN (pep´sin) *n.* the ferment of the stomach juice which helps to digest proteins.

PEPTONISE (pep´tō-nīz) *v.t.* partially to digest proteins by means of pepsin.

PERCEPT (pẹr´sept) *n.* that which is perceived by means of the senses.

PERICARDITIS (pe-ri-kår-dī'-tis) *n.* inflammation of the membrane surrounding the heart.—**pericardium**.

PERIOSTEUM (pe-ri-os'-ti-um) *n.* the tough membrane which clothes the bones.—**periosteal** *a.*—**periostitis** (pe-ri-os-tī'-tis) *n.* inflammation of this membrane.

PERISTALSIS (pe-ri-stal'-sis) *n.* the rhythmic, muscular movements of the intestines by which the contents are forced onwards.

PERITONEUM (pe-ri-to-nē'-um) *n.* the smooth lining membrane of the abdominal cavity.

PERITONITIS (pe-ri-to-nī'-tis) *n.* inflammation of the peritoneum.

PESSARY (pes'-ạ-ri) *n.* an instrument placed in the vagina to correct malpositions of the womb; an instrument to prevent conception.

PETIT MAL (pe'-ti-mal') *n.* a minor epileptic seizure.

PHAGOCYTE (fag'-o-sīt) *n.* a white blood corpuscle which devours germs of disease.

PHAGOCYTOSIS (fag-o-sī-tō'-sis) *n.* the act of white blood corpuscles devouring germs.

PHALANGES (fạ-lan'-jēs) *n.pl.* the small bones of the fingers and toes.

PHARMACEUTICAL (får-mạ-sū'-ti-kạl) *a.* pertaining to drugs.

PHARMACOPŒIA (får-mạ-ko-pē'-yạ) *n.* an authorised handbook of directions for composing medicines.

PHARYNX (fạ'-rinks) *n.* p. 482.

PHIMOSIS (fim-ō'-sis) *n.* the condition of having a tight foreskin.

PHOBIA (fō'-bi-ạ) *n.* a morbid fear.

PHRENOLOGY (fren-ol'-ō-ji) *n.* the theory that the various faculties of the mind can be connected with certain parts of the brain.

PHTHISIS (thī'-sis) *n.* consumption.

PHYSIOGENIC (fiz-i-ō-jen'-ik) *a.* p. 977.

PHYSIOLOGY (fiz-i-ol'-ō-ji) *n.* the science of the normal functions of living things.

PIA MATER (pi'-ạ mā'-tẹr) *n.* the delicate membrane closely investing the brain.

PIGMENTATION (pig-men-tā'-shun), *n.* discoloration of the skin.

PINEAL GLAND (pin'-ē-ạl gland) *n.* a small gland at the base of the brain believed to have an internal secretion.

PITUITARY (pi-tū'-i-tạ-ri) *n.* p. 618.

PLACENTA (plạ-sen'-tạ) *n.* after-birth; the flesh-like body by means of which the mother nourishes the foetus.

PLASMA (plas'-mạ) *n.* p. 434.

PLASMODIUM (plas-mō'-di-um) *n.* the parasite of malaria.

PLETHORIC (ple-thō'-rik) *a.* pertaining to **plethora**—fulness, an excess of blood.

PLEURISY (plōō'-ri-si) *n.* inflammation of the **pleura** or lining membrane of the lungs.

PLEURODYNIA (plōō-rō-din'-i-ạ) *n.* rheumatism of the muscles between the ribs.

PLEXUS (plek'-sus) *n.* a network of vessels, etc.

PLUMBISM (plum'-bizm) *n.* lead-poisoning.

PNEUMOCOCCUS (nū-mō-kok'-us) *n.* the germ which sometimes causes pneumonia, etc.

PNEUMOCONIOSIS (nū-mō-kon-i-ō'-sis) *n.* a term including all forms of dust disease of the lungs.

PNEUMOGASTRIC (nū-mō-gas'-trik) *a.* pertaining to the vagus or tenth cranial nerve.

PNEUMONIA (nū-mō'-ni-ạ) *n.* inflammation of the lungs.—**pneumonic** (nū-mon'-ik) *a.*

PNEUMOTHORAX (nū-mō-thō'-raks) *n.* the presence of air in the pleural cavity.

PODAGRA (po-dag'-rạ) *n.* gout.

POLIO-ENCEPHALITIS (pol'-i-ō-en-se-fạ-lī'-tis) *n.* polio-myelitis, involving the brain also.

POLIO-MYELITIS (pol'-i-ō-mī-e-lī'-tis) *n.* an acute infection of the spinal cord occurring chiefly in children **(infantile paralysis).**

POLITZERISATION (pol-it-zẹr-ī-zā'-shun) *n.* p. 699.

POLYMORPHISM (pol-i-mor'-fizm) *n.* ability to take a number of different shapes or forms.

POLYMORPH-PERVERSITY (pol'-i-morf-pẹr-vẹr'-si-ti) *n.* a Freudian term describing the development of sexual instinct in children.

POLYNEURITIS (pol-i-nū-rī'-tis) *n.* inflammation of many of the nerves of the body,.

POLYOPIA (pol-i-ō'-pi-ạ) *n.* the state of seeing the same thing multiplied.

POLYPUS (pol'-i-pus) *n.*; *pl.* **polypi,** a small simple tumour occurring in the nose, etc.

POLYURIA (pol-i-ū'-ri-ạ) *n.* the passage of large quantities of urine at frequent intervals.

POPLITEAL (pop-li-tē'-al) *a.* p. 392.

PORENCEPHALIC (po-ren-sef-al'-ik) *a.* referring to a cystic condition of the brain.

PORTAL VEIN (por'-tạl vān) *n.* p. 392-3.

POST-NATAL (pōst-nā'-tạl) *a.* after birth.

PRESBYOPIA (pres-bi-ō'-pi-ạ) *n.* long sight.

PROGNOSIS (prog-nō'-sis) *n.* the science of foretelling the course of a disease.

PROLAPSE (prō-laps') *n.* downward displacement of an internal organ.

PROPHYLACTIC (prof-i-lak'-tik) *a.* preventing disease.—**prophylaxis** (prof-i-lak'-sis) *n.*

PROSTATE (GLAND) (pros'-tāt) *n.* a gland at the neck of the male bladder.

PROTEIN (prō'-ti-in) *n.* an organic substance represented in the flesh of animals, etc.

PROTOPLASM (prō'-to-plazm) *n.* the jelly-like material forming animal cells.

PROTOZOON (prō-to-zō'-on) *n.*; *pl.* **-zoa,** an animal of the lowest and simplest class.

PRO-VITAMIN (prō-vī'-tạ-min) *n.* a substance which, under certain influences, *e.g.*, sunlight, develops into the actual vitamin.

PRURITIS (prōō-rī'-tis) *n.* local skin irritation, generally in the region of the excretory organs.

PSYCHIATRIST (sī-kī'-ạ-trist) *n.* a physician who cares for the insane.

PSYCHOGENIC (sī-kō-jen'ik) *a.* p. 977.
PSYCHOSIS (sī-kō'sis) *n.* severe mental disorder; insanity.—**psychotic** (sī-kot'ik) *a.*
PSYCHOLOGY (sī-kol'ō-ji) *n.* the science of the human mind.
PTYALIN (tī'ạ-lin) *n.* the ferment of the saliva which converts starches into sugars.
PUBERTY (pū'bẹr-ti) *n.* the age at which the reproductive organs in both sexes begin to be functionally active.
PUBIC (pū'bik) *a.* referring to the hair-covered region about the sexual organs.
PUERPERAL (pū-ẹr'pe-rạl) *a.* relating to childbirth.
PULMONARY (pul'mo-nạ-ri) *a.* relating to the lungs.
PUNCTUM (punk'tum) *n.* a small aperture.
PURIN (pū'rin) *n.* a product of the digestion of nucleo-proteins, *e.g.*, liver.
PURPURIC (pur-pū'rik) *a.* referring to **purpura,** a condition in which there are purple-red spots on the skin.
PUS (pus) *n.* matter; consists of dead body-cells and germs.—**pustule** *n.* a pimple.
PYLORUS (pi-lo'rus) *n.* p. 484.—**pyloric** *a.*
PYOGENIC (pī-ō-jen'ik) *a.* pus-producing.
PYORRHŒA (pī-ō-rē'ạ) *n.* suppuration of the gums.
PYREXIA (pī-rek'si-ạ) *n.* feverishness.
PYROMETER (pī-rom'e-tẹr) *n.* an instrument for measuring high temperatures.

Q

QUINQUENNIUM (kwin-kwen'i-um) *n.* *pl.* **quinquennia,** a period of five years.
QUINSY (kwin'zi) *n.* acute tonsilitis.

R

RACHITIC (rạ-kit'ik) *a.* referring to rickets.
RADIAL (rā'di-ạl) *a.* referring to the radius.
RADIO-ACTIVITY (rā-di-ō-ak-tiv'i-ti) *n.* the power possessed by certain substances, such as radium, to give off rays which can penetrate opaque matter.
RADIOGRAPH (rā'di-ō-grȧf) *n.* an X-ray photograph.
RADIOTHERAPY (rā-di-ō-the'rạ-pi) *n.* treatment by X-rays and radium.
RADIUS (rā'di-us) *n.*; *pl.* **radii,** the slender bone on the outer side of the forearm.
RADON (rā'don) *n.* radium emanation.
RANULA (ran'ū-lạ) *n.* p. 841.
RE-AGENT (rē-ā'jent) *n.* a substance which reacts on and detects the presence of others.
RECRUDESCENCE (rē-kroo-des'ens) *n.* the state of becoming sore again; a relapse.
RECTOCELE (rek'tō-sēl) *n.* p. 900.
RECTUM (rek'tum) *n.* the lower end of the large intestine, from the colon to the anus.
RENAL (rē'nạl) *a.* referring to the kidney.
RENNIN (ren'in) *n.* the ferment of the stomach juice which curdles milk.
RHIZOME (rī'zōm) *n.* a root-stock.
RICKETS (rik'ets) *n.* a bone disease due to deficiency of vitamin D in the diet.
RIGOR (rig'or) *n.* a sudden attack of shivering.
RIGOR MORTIS (rī'gor mor'tis) *n.* the stiffening of the body after death.
ROUGHAGE (ruf'ij) *n.* the tough fibrous material in vegetables and fruits which stimulates bowel action.

S

SACRUM (sā'krum) *n.*; *pl.* **sacra,** the lowest portion of the spinal cord.—**sacral** *a.*
SACULATED (sak'ū-lā-ted) *a.* baggy; pursed.
SALINE (sā'līn) *a.* containing salt.
SALIVA (sạ-lī'vạ) *n.* the watery fluid poured into the mouth by the salivary glands.
SAPONIFICATION (sạ-pon-i-fi-kā'shun) *n.* the converting of a substance into soap.
SAPROPHYTIC (sap-rō-fit'ik) *a.* living on dead tissues, a term applied to germ life.
SARCINA (sȧr'sin-ạ) *n.*; *pl.* **sarcinæ,** p. 1010.
SARCOMA (sȧr-kō'mạ) *n.*; *pl.* **sarcomata,** a malignant tumour.
SCAPHOID (skaf'oid) *n.* a small bone in the foot.—*a.* boat-shaped.
SCAPULA (skap'ū-lạ) *n.* the shoulder-blade.
SCIRRHUS (si'rus) *a.* hard, usually applied to certain cancerous tumours.
SCLERA (skle'rạ) *n.* p. 673.
SCLEROSIS (skle-rō'sis) *n.* hardening.
SCOLIOSIS (skol-i-ō'sis) *n.* lateral curvature of the spine.
SCROFULA (skrof'ū-lạ) *n.* tubercular disease of bones and glands.—**scrofulous** *a.*
SCROTUM (skrō'tum) *n.* the skin bag which holds the testicles or male sexual glands.
SCURVY (skur'vi) *n.* a disease due to deficiency of vitamin C in the diet.
SEBACEOUS (se-bā'shus) *a.* fatty; secreting oily matter.
SEMINAL (sem'i-nạl) *a.* relating to **semen** or seed.
SENSORY NERVE (sen'so-ri nẹrv) *n.* a nerve which conveys impressions to the brain.
SEPSIS (sep'sis) *n.* the state of infection with pus-forming germs.
SEPTICÆMIA (sep-ti-sē'mi-ạ) *n.* the invasion of the blood by micro-organisms etc.
SEPTUM (sep'tum) *n.* a division between two cavities, *e.g.*, in the nose.
SEROUS (sē'rus) *a.* relating to serum; watery.
SERUM (sē'rum) *n.* the fluid part of the blood.
SESSILE (ses'il) *a.* having no stem.
SEX-HORMONE (seks-hor'mōn) *n.* the internal secretion of the sex glands which controls sexual development.
SIDEROSIS (sid-e-rō'sis) *n* p. 1596.

SILICOSIS (sil-i-kō´sis) *n.* p. 1596.

SIGMOID (sig´moid) *a.* curved like the Greek letter sigma or like *S*; a term applied especially to a bend of the colon.

SINO-AURICULAR NODE (sī-nō-aw-rik´ū-lar nōd') *n.* the centre of the heart from which the impulses for its contraction originate.

SINUS (sī´nus) *n.* a passage leading from an abscess; some inner part to an opening

SPECULUM (spek´-ū-lum) *n.* an instrument for examining the passages of the body.

SPERMATIC (sper-mat´ik) *a.* pertaining to the sperm-cells.

SPERMATOZOON (sper-ma-tō-zō´on) *n.*; *pl.* **-zoa** the male sex cell, or **sperm-cell**.

SPHINCTER (sphingk´ter) *n.* a circular muscle controlling the orifice of some hollow organ.

SPINE (spīn) *n.* the backbone.

SPIRILLUM (spī-ril´um) *n.*; *pl.* -a, p. 1011.

SPIROCHÆTE (spī´rō-kēt) *n.* p. 1018.

SPLANCHNIC (splangk´nik) *a.* pertaining to the organs in the abdominal cavity.

SPORADIC (spo-rad´ik) *a.* scattered, a term applied to any infectious disease which attacks only a few persons in a district and does not spread in its ordinary manner.

SPORULATE (spor´ū-lāt) *v.i.* to form spores.

SPUTUM (spū´tum) *n.* expectorated matter.

STAPHYLOCOCCUS (staf´i-lō-kok-us) *n.*; *pl.* **staphylococci,** p. 1010.

STATIC (stat´ik) *a.* pertaining to bodies at rest.

STEARIN (stē´a-rin) *n.* a fat.

STENOSIS (sten-ō´sis) *n.* contraction of a canal or orifice.

STERILISE (ste´ri-līz) *v.t.* to render free from germs.

STERNUM (ster´num) *n.* the breast bone.

STEROL (ste´rol) *n.* p. 1289.

STERTOR (ster´tor) *n.* the snoring sound of breathing often heard in apoplexy.

STETHOSCOPE (steth´o-skōp) *n.* the instrument by means of which a physician can listen to heart sounds and respiratory murmurs.

STOMACHIC (sto-mak´ik) *n.* a medicine for the stomach.

STOOLS (stōōlz) *n. pl.* discharges of fæces.

STREPTOCOCCUS (strep´tō-kok-us) *n.*; *pl.* **streptococci,** a chain form of bacteria, sometimes responsible for grave septicæmias.

STRIATED (strī´ā-ted) *a.* striped.

STRIDOR (strī´dor) *n.* a harsh sound during breathing caused by obstruction.

SUBCLAVIAN (sub-klā´vi-an) *a.* under the clavicle or collar-bone.

SUBCUTANEOUS (sub-kū-tā´ni-us) *a.* under the skin.

SUBLIMATION (sub-li-mā´shun) *n.* the expression of crude instinctive impulses as higher creative work.

SUBLINGUAL (sub-ling´gwal) *a.* under the tongue.

SUBMAXILLARY (sub-mak´sil-a-ri) *a.* under the jaw-bone.

SULCUS (sul´kus) *n.* a fissure; usually applied to the fissures of the brain.

SUPERNATANT (sū-per-nā´tant) *a.* floating on the surface.

SUPPURATION (sup-ū-rā´shun) *n.* the formation of pus or matter.

SUPRARENAL GLAND (sū-pra-rē´nal gland) *n.* the adrenal gland (*q.v.*)

SUTURE (sū´tūr) *n.* a term applied to the joints between flat bones, as in the skull; material such as silk, silver thread, or catgut used to unite the cut surfaces of a wound.

SYMBIOSIS (sim-bi-ō´sis) *n.* the living together of two organisms, whose mutual association is necessary to both.

SYMPATHETIC NERVOUS SYSTEM (sim-pa-thet´ik ner´vus sis´tem) *n.* that part of the nervous system not under voluntary control.

SYMPHYSIS PUBIS (sim´fi-sis pū´bis) *n.* the bony mass bounding the front of the pelvis.

SYNCOPE (sing´ko-pē) *n.* fainting.

SYNDROME (sin´drōm) *n.* an association of symptoms characteristic of certain diseases.

SYNOVIAL FLUID (si-nō´vi-al flōō´id) *n.* the joint fluid secreted by the joint membrane.

SYNOVITIS (si-nō-vī´tis) *n.* inflammation of the lining membrane of a joint cavity.

SYNTHESIS (sin´the-sis) *n.* the building up of complex substances by the union and interaction of simple materials.

SYSTEMIC VEIN (sis-tem´ik vān) *n.* one of the veins which carry blood from the body organs and tissues to the heart.

SYSTOLE (sis´to-lē) *n.* the contraction of the heart in its beat.

T

TABO-PARESIS (tā-bō-pa-rē´sis) *n.* locomotor ataxia (*q.v.*)

TACTILE (tak´til) *a.* referring to touch.

TARSUS (tàr´sus) *n.* the seven small bones of the foot; the cartilage of the eyelid.

TARTAR (tàr´tar) *n.* incrustation on the teeth.

TELANGIECTASIS (tel-an-ji-ek-tā´sis) *n.* a small skin-tumour of dilated blood-vessels.

TELEGONY (te-leg´o-ni) *n.* p. 266.

TEMPORAL (tem´po-ral) *a.* referring to the bones at the side of the skull.

TENDON (ten´don) *n.* a sinew or cord of fibrous white tissue by which a muscle is attached to a bone—**tendinous** *a.*

TENESMUS (te-nes´mus) *n.* a painful griping sensation experienced when an attempt is made to defecate in certain conditions.

TERPENE (ter´pēn) *n.* the principal constituent of an essential oil.

TESTICLE (tes´ti-kl) *n.* one of the two glands of the scrotum which secrete the semen.

TETANUS (tet′a-nus) *n.* lockjaw.
THEOBROMINE (thē-ō-brō′mēn) *n.* the alkaloid present in cocoa.
THERAPY (the′ra-pi) *n.* treatment of disease.
THORAX (tho′raks) *n.* the chest cavity which holds the heart and lungs. –**thoracic** *a.*
THROMBOSIS (throm-bō′sis) *n.* p. 1169.
THROMBUS (throm′bus) *n.* 388.
THYMUS (thī′mus) *n.* a gland at the root of the neck in children.
TIBIA (tib′i-a) *n.* the shin-bone, or larger bone of the leg below the knee.– **tibial** *a.*
TINNITUS (ti-nī′tus) *n.* ringing in the ears.
TORTICOLLIS (tor-ti-kol′is) *n.* wry-neck.
TOURNIQUET (tōōr′ni-ket) *n.* an instrument to exert pressure on an artery to stop bleeding.
TOXÆMIA (tok-sē′mi-a) *n.* poisoning from germ **toxins** (poisons).– **toxic** *a.*
TRACHEA (trak′i-a) *n.* the wind-pipe.
TRAUMA (traw′ma) *n.* a wound or injury.— **traumatic** (traw-mat′ik) *a.*
TREPANNING (tre-pan′ing) *n.* the operation of removing a piece of the skull to gain access to the brain.
TRICHINIASIS (trik-i-nī′a-sis) *n.* see below.
TRICHINOSIS (trik-i-nō′sis) *n.* infection with a parasitic worm named **trichina.**
TROCAR (trō′car) *n.* an instrument used with a cannula to draw off fluids from the body.
TROCHANTER (trō-kan′ter) *n.* one of the two processes at the junction of the neck and shaft of the femur or thigh-bone.
TROPISM (trō′pizm) *n.* a simple reaction or response to a stimulus.
TRYPSIN (trip′sin) *n.* the ferment of the pancreatic juice which digests proteins.
TUBERCULIN (tū-ber′kū-lin) *n.* a preparation from cultures of tubercle bacilli used in the diagnosis and treatment of tuberculosis.
TUMOUR (tū′mur) *n.* an enlargement due to a permanent morbid growth.
TURBINAL (tur′bi-nal) *a.* a term applied to three small convoluted bones of the nose.
TYMPANIC MEMBRANE (tim-pan′ik mem′brān) *n.* the ear drum.

U

ULCER (ul′ser) *n.* a sore attended by discharge.
ULNA (ul′na) *n.*; *pl.* **ulnæ,** the bone in the inner part of the forearm.—**ulnar** *a.*
UMBILICUS (um-bil′i-kus) *n.* the navel.
UNGUENT (ung′gwent) *n.* an ointment.
URACHUS (ū-rā′kus) *n.* the urinary canal of the foetus.
URÆMIA (ū-rē′mi-a) *n.* accumulation of urinary substances in the blood.
UREA (ū′ri-a) *n.* a solid constituent of urine.
URETER (ū-rē′ter) *n.* the narrow tube which conveys the urine from kidney to bladder.
URETHRA (ū-rē′thra) *n.* the canal through which the urine is discharged.
URIC ACID (ū′rik as′id) *n.* a waste product which is excreted in the urine.
URTICARIA (ur-ti-kā′ri-a) *n.* nettle-rash.
UTERUS (ū′te-rus) *n.* the womb.
UVULA (ū′vū-la) *n.* a small fleshy body hanging down at the back of the soft palate.

V

VACCINE (vak′sin) *n.* a suspension of dead or weakened germs prepared for introduction into the body to prevent a specific disease.
VAGINA (va-jī′na) *n.* the birth-canal.
VAGUS NERVE (vā′gus nerv) *n.* one of the tenth pair of cranial nerves which supply the lungs, heart, and stomach.
VASCULAR (vas′kū-lar) *a.* referring to blood-vessels.
VASO-CONSTRICTOR (vas-o-kon-strik′tor) *a.* constricting the muscles of the arteries, thus diminishing their calibre.
VASO-MOTOR (vas-o-mō′tor) *a.* causing contraction or dilatation of blood-vessels.
VENA CAVA (vē′na cā′va) *n.pl.* **venæ cavæ,** one of two large veins which pour blood into the right auricle of the heart.
VENEREAL (ve-nē′ri-al) *a.* relating to sexual intercourse.
VENOUS (vē′nus) *a.* referring to the **veins.** the tubes which convey blood to the heart.
VENTRICLE (ven′tri-kl) *n.* a cavity within an organ, *e.g.*, in the brain and the heart.
VENULE (ven′ūl) *n.* a very small vein.
VERBAL-MOTOR (ver-bal-mō′tor) *a.* referring to the centre in the brain which controls the muscles of speech.
VERNIX CASEOSA (ver′niks cas-i-ō′sa) *n.* the fatty material which covers the foetus.
VERTEBRA (ver′te-bra) *n.*; *pl.* **vertebræ,** one of the small bones that form the spine.
VERTIGO (ver′ti-gō) *n.* giddiness.
VESICLE (ves′i-kl) *n.* a bladder; a blister.
VILLUS (vil′us) *n.*; *pl.* **villi,** a fine soft process– a core of fibrous tissue lined by cells.
VISCERA (vis′e-ra) *n.pl.* internal organs.
VISCID (vis′id) *a.* glutinous, sticky, tenacious.
VISCOUS (vis′kus) *a.* glutinous.—**viscosity** *n.*
VITAMIN (vī′ta-min) *n.* a group of essential food-factors present in unrefined foods.

X

XANTHOPHYLL (zan′tho-fil) *n.* yellow pigment contained in plants.
XEROPHTHALMIA (zē-rof-thal′mi-a) *n.* an eye disease due to deficiency of vitamin A.

Z

ZEIN (zē′in) *n.* the chief protein in maize.
ZOOPHYTE (zō′o-fit) *n.* a simple type of sedentary animal, resembling a plant.
ZYGOMA (zī-gō′ma) *n.* the cheek-bone.

fāte, fâr, ado; mē, her; nīne; trūe; mōōn.

GENERAL INDEX

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This index is arranged to facilitate immediate reference to the principle articles on the various subjects included in *The Golden Health Library*, and especially to guide readers at once to the First Aid treatment for cases of emergency.

The page references to the main articles are therefore given in black type, thus: **Choking,** first aid in, **1085-6, 1156**; the ordinary numerals referring to subsidiary entries Where no confusion can arise, the references in the Index are grouped as far as possible under the same headings as are used in the body of the work

Details in the main articles are not indexed under the main heading, and reference should be made to the article itself. Thus, for instance, subsidiary items in the article on X-rays are not fully listed under the heading **X-rays,** the further entries there including only the references to the subject occurring elsewhere in the work Cross-references given in the Index refer only to the Index pages, a complete guide to the inter-relations between the various subjects being provided by the cross-references in the work itself.

References to the illustrations in the work are denoted throughout by page numbers in italics, thus *1286*.

A

B